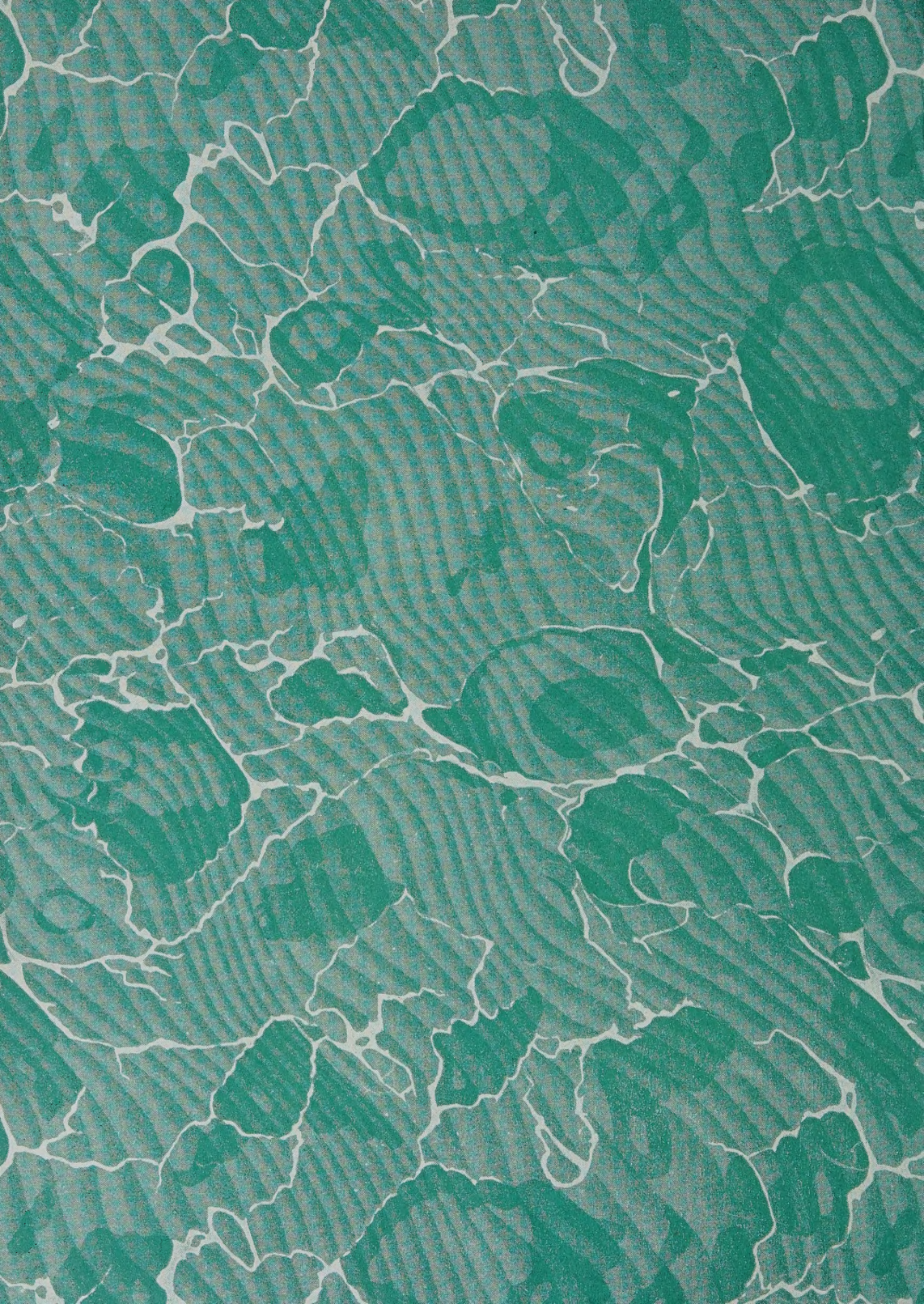
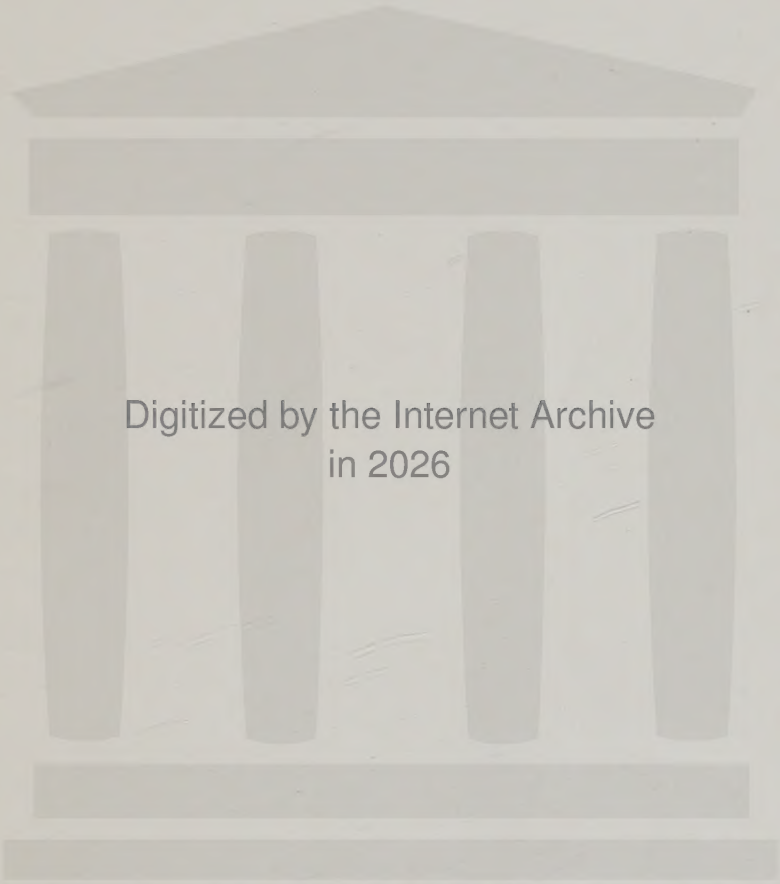
SAN FRANCISCO'S HORROR OF EARTHQUAKE AND FIRE

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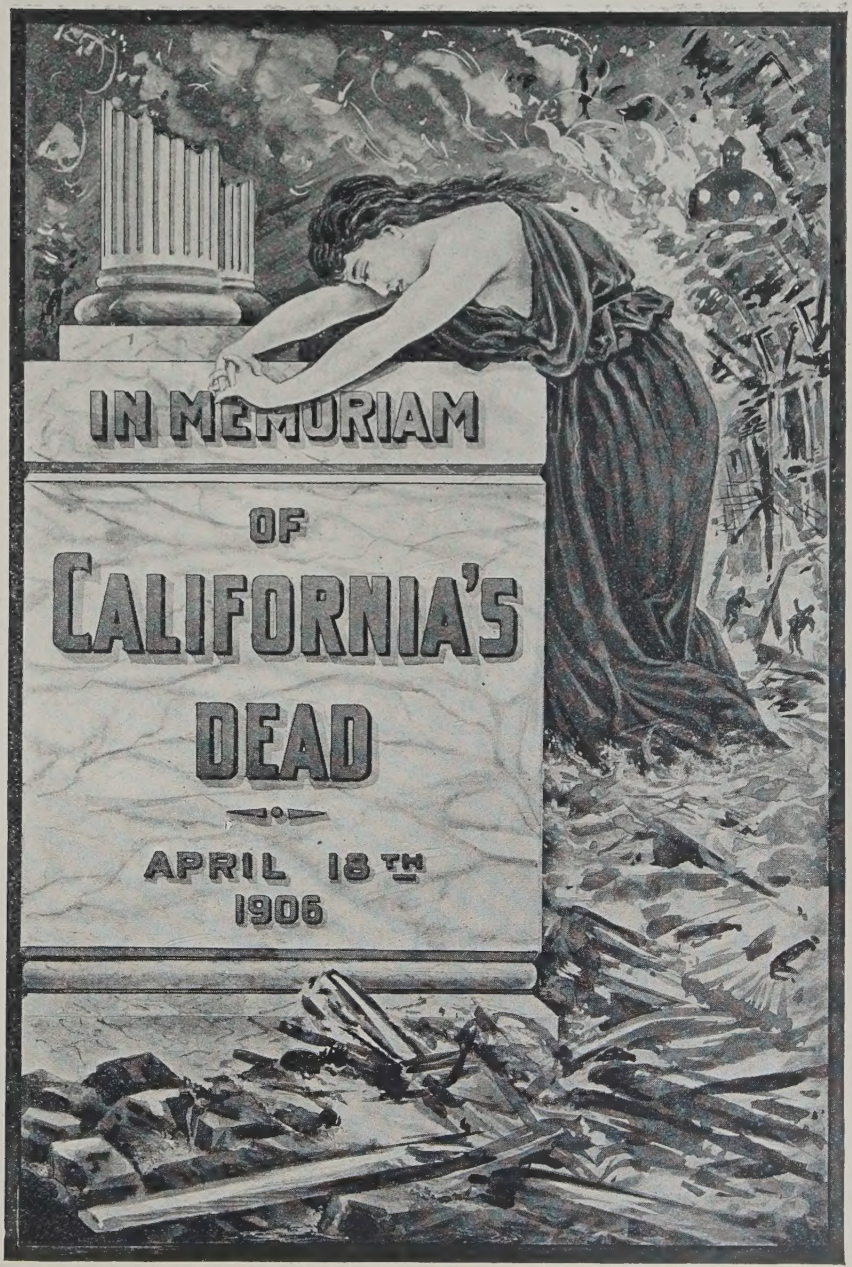
IN MEMORIAM
OF
CALIFORNIA'S
DEAD
APRIL 18TH
1906

CLIFF HOUSE AND SEAL ROCKS. One of the chief attractions of the city was the Cliff House, situated on Point Lobos, at entrance of Golden Gate.

FORT POINT and "GOLDEN GATE" entrance to San Francisco Bay. One of the finest harbors in the world. The Golden Gate is one and a half miles wide.

CITY HALL—Cost about $6,000,000. The main dome rises to a height of 335 feet and cost over $400,000.

NEWSPAPER ROW. Corner of Market, Kearny and Third Streets.

THE PALACE HOTEL. Renowned as one of the finest hostelries in America.

The Inner Court of PALACE HOTEL. This court was recently fitted up at a great expense, giving it a grand and home-like appearance.

SUTRO HEIGHTS. Located on the bluffs above the Cliff House. From here a grand view of the ocean and bay can be had.

SAN FRANCISCO'S HORROR

OF

EARTHQUAKE AND FIRE

TERRIBLE DEVASTATION AND HEART-RENDING SCENES

IMMENSE LOSS OF LIFE AND HUNDREDS OF MILLIONS OF PROPERTY DESTROYED

THE MOST APPALLING DISASTER OF MODERN TIMES

CONTAINING

A VIVID DESCRIPTION OF THIS OVERWHELMING CALAMITY—SUDDENNESS OF THE BLOW—GREAT NUMBER OF VICTIMS—FALL OF GREAT BUILDINGS—THOUSANDS DRIVEN FROM THEIR HOMES

THIS UNPARALLELED CATASTROPHE

LEAVES SAN FRANCISCO A HEAP OF SMOULDERING RUINS—FIERCE FLAMES SWEEP THE DOOMED CITY BEAUTIFUL BUILDINGS IN ASHES

TO WHICH IS ADDED

GRAPHIC ACCOUNTS OF THE ERUPTIONS OF VESUVIUS AND MANY OTHER VOLCANOES, EXPLAINING THE CAUSES OF VOLCANIC ERUPTIONS AND EARTHQUAKES

COMPILED FROM STORIES TOLD BY EYE WITNESSES OF THESE FRIGHTFUL SCENES

By JAMES RUSSEL WILSON, the Well-known Author

Embellished with a Great Number of Superb Photographic Views taken before and after the Terrible Calamity.

ENTERED ACCORDING TO ACT OF CONGRESS, IN THE YEAR 1906, BY

G. W. BERTRON

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INTRODUCTION.

SHIVERING, but sure in its rock-ribbed grasp, the hand of Destruction has reached up through the thin crust of the world and, waving a giant torch of quenchless flame, swept from her proud seat at the edge of the sunset sea the splendid city of the Golden Gate.

But yesterday the inbound mariner saw from his lookout her jeweled hills, aglow with life. As his prow cleaved the clear green of the Pacific and bore him on to the matchless harbor he marked the towers and columns, the serried ranks of homes and the great ships cradled at this door of commerce.

To-day he sees a shroud of smoke, outspread above a charred skeleton. A great wail of distress is borne across the waters which lap these shores of desolation. From out the black playground of Death rise huge phantom shapes of Hunger and Thirst. A mass of smouldering embers tell grimly of Nature's dread orgies.

Three terrible minutes have vanquished the work of years.

A shiver of fevered pain has swept along the spine of Earth, and San Francisco is ashes.

Out of the curling smoke that rises like incense for the dead and destroyed two pictures are formed.

One is a scene of horror beyond the power of words to depict. It is a picture of men and women being roused from dreams of the dawn to the sternest reality of Night—Night aflame with huge torches of consuming greed, eating their way unimpeded through the vitals of human effort.

There is nothing to turn to. The very ground, upon which all has been based, is rising and falling like the waves of the ocean beyond, and the shrieks of the pierced and pinned mingle with the weeping of the homeless and childless and fatherless.

Nature has plotted well. She has cut the arteries of protection against

fire, and the blazing demon leaps and dances through walls and high-built battlements of stone as though they were paper.

So awful is the task that Earth itself still trembles at the thought of all that is. A sick sun looks down on the ruins.

The other picture is different.

It is a picture of the human heart, often called cold and cheerless in these days—the human heart of the whole world melted by these same flames into one vast mass of charity.

The first gasp of horror is not spent before a helping hand is stretched out to the city of desolation. Every village in the land hastens to do its share. The call of the hungry and homeless is answered almost before it is heard. No purse remains unopened. No effort lags.

A traveler has fallen by the sea. The world is a Good Samaritan, stooping to bind his wounds, and with willing hands lifting him to start again on his journey.

Out of these ruins rises the sun of human brotherhood, and, though it be soon clouded in the renewed rage for place and gain, the world will be brighter and better because of its having shone.

San Francisco shall not have died in vain. There will be a resurrection of Charity.

And there should be a resurrection of something else.

Through this ghastly veil of loss and suffering we should be able to see a sign. It can be seen at other times, but such times as these seem to make it shine out more clearly.

What is all our planning and striving for temporal gain? What is all our rushing and rising, our seeking and obtaining, our boasting and pride in the accomplishments of our own hands?

Do we not allow these insignificant things to blind us to greater truths? Can we not learn from these ruins something of value, something that will in a measure make up for the loss and destruction?

Yes, if we will.

We can learn that it is not well to tempt Nature. Men have always known that the ground upon which San Francisco was built was unstable. They have always known there was a possibility of just what has happened.

We can learn something of value as to our own stature in the universe.

It would seem we needed a lesson of the sort in times when man and man's work are given such large consideration, and God and God's work so little, comparatively.

It is blasphemy to assume that such a disaster as this is a visitation of the Almighty. But it is sanity of the best sort to believe that it is a good illustration of the weakness of man when unaided by the countless gifts of the Creator.

And no nation needs to learn this more than our own.

We have been so favored by every wind that blows that we have grown insolently proud in many an instance. We have contracted a habit of thinking we are always right and others always wrong when not agreeing with us.

We need a great deal more humility of spirit than we have, and while we do not believe such a disaster as this is "sent" to awaken us to our lack, it is well that we should get out of it all the good there may be in it.

The beginning of San Francisco's late greatness was the discovery of gold in California. In a mad rush for the precious stuff men disregarded all caution as to the nature of the country into which their desire for fortune led them, and though repeatedly warned by Nature herself, persisted in placing their estimate above hers.

In a thousand ways we are lured on by gold. If we could only see above all other sorts of gold the everlasting gold of good and make that the goal of our seeking, how much safer and happier we might be!

How often are we lured on by the gleam of the Golden Gate in the distance, only to find, when we have come to the place where we thought it was, a mass of smouldering ruins!

Where San Francisco lies prone in its ashes, and looks up to its desolated hills, will arise a new and splendid city. Yet when it has been builded, and the bitterness of the present time forgotten, then will abide a sense of loss. The old San Francisco is no more, and never can it be recalled save as a memory. The local color, atmosphere, that which might be termed temperament, vanished with the clustered houses, as rich in tradition as the ancient missions in whose cloisters worshiped the Spanish padre "before the Gringo came."

While many Americans knew San Francisco, more of them knew

Paris, London and Rome. To most of them this fair city of their own land was as a place distant and foreign. But such as entered it, and learned of its people and their ways, learned to love it.

Unique it was, almost grotesque perhaps, certainly defiant of precedent in its customs, its pleasures, its manner of living. One who had stood on an eminence there, beholding a vision of ocean, bay and circling mountains, had seen the billowing fog banks roll in through the Golden Gate, crowning the abrupt slopes of Saucelito until in the sky there seemed a range of fantastic mountains, in their phantom valleys shifting lakes that changed tints with the sun, remembered ever after a panorama beautiful and appealing. This picture no fury of rocking earth may destroy.

But the scenic impressiveness only prepared the mind for appreciation of that part of San Francisco which has been swept into history, and which hardly may be described. It was a very essence, a subtle difference, not so much in mental attitude and moral perception and warmth of fellowship—although all of these quickly might be discerned—as in the form of the expressions these qualities had taken.

One of San Francisco's charms was in its defiance of precedent. There were hills to be conquered, and San Francisco's expanding traffic hurled itself at the face of them. It went up and up, with no thought of finding a way around. So it happened that on some of the streets the steepness was too great for horses. In the centre there are cable roads, and on either side of the rails grass grows through the cobbles. The earlier structures on the level were put together in haste. For the most part they remained essentially unchanged until they fell with a crash. True, they had become stained by time, unkempt, dwarfed by new neighbors, but nobody desired to efface them.

Away from the business section houses appeared on the various hills, perched precariously near the brink; houses reached by long flights of steps and grown over with roses. The bathing fogs touched them with gray. Moss grew on their roofs. In the little, lofty yards calla lilies bloomed with the profusion of weeds. But inside these homes what hospitality! as inside the rickety restaurants down toward the water front there was cheer.

The "two bit" dinner of the Italian or Mexican chef in New York

would have cost ten times as much. Those whom they drew into comradeship, no matter from what rank in Bohemia or of Philistines astray, were made acquainted with a pervasive equality not witnessed elsewhere in civilization.

The natural beauty of the site, the quaintness of the commercial and social development of which it became the centre, attracted the poet and the artist. It incited them to paint the attractions and to sing the praises of their chosen habitat. For the outside world, who cared? Surely not they. They lived in a world of their own, and it was good enough.

Now and then some member of the group went to the larger world outside, and perchance found fame, but the heart of the wanderer turned back to the gray and shadowy city. Here Stevenson paused before going to the islands to die, and made his home in a rookery. Happy and content was he, as he sat for hours in Portsmouth Square, where now a monument to his memory has been jarred askew. Here young Norris gathered the inspiration for his books. Here, too, in an older day, Bret Harte did his best work and Mark Twain found his real beginning.

The people of San Francisco know the shock of calamity, but they do not know defeat. They will have their city again. It cannot be the old city, nor suggestive of the old. Disaster seems to have swept away the barriers that afforded pleasing isolation. The new San Francisco will be as other prosperous cities, its distinctiveness only that which springs from its site as an outpost overlooking the Pacific.

GOLDEN GATE—Bay of San Francisco.

MAGNIFICENT STATUE, erected by bequest of late Peter Donahue.
Battery, Bush and Market Sts.

UNITED STATES MINT. One of the handsomest buildings in San Francisco. It contains the finest collection of coins in the world.

MUSEUM in Golden Gate Park. This is an elegant structure in the Egyptian style of architecture, and contains superb paintings and relics.

THE HOPKINS ART INSTITUTE, destroyed by fire. Gothic architecture; is beautiful and commands a superb view of San Francisco.

MUSIC STAND in Golden Gate Park. Thousands assemble here weekly, winter and summer, to hear the music.

UNION SQUARE as it appeared before the Earthquake. The monument in the centre was erected in commemoration of Admiral Dewey's Victory in the Bay of Manilla

UNION FERRY DEPOT. Foot of Market Street, San Francisco.

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Scene in San Francisco on arrival of the first relief train filled with provisions and clothing for the half starved and scantily dressed sufferers.

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LOOKING DOWN KEARNEY STREET at intersection of Broadway, San Francisco.

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ITALIAN SECTION, known as Barbary Coast, looking east down Vallejo street. This picture shows the flames gradually but surely destroying this portion of San Francisco.

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VIEW FROM VALLEJO STREET, showing center of the business district with the fire sweeping down Market street.

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VIEW OF JEFFERSON SQUARE showing refugees encamped. Rich and poor received the same treatment. All were held prisoners by the flames for several days.

This picture shows the complete destruction of many of the elegant dwellings in the residential portion of the city, some of which were smouldering when this photograph was taken.

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VIEW FROM TELEGRAPH HILL, the first day of the fire, showing Hayward, Merchants Exchange and Mills buildings in order from left to right.

BIRD'S-EYE VIEW

SHOWING THE BUSINESS DISTRICT, NOB HILL, CLIFF HOUSE, SAN

AN FRANCISCO

CO BAY, GOLDEN GATE AND PACIFIC OCEAN IN THE DISTANCE.

This scene shows buildings that were partly destroyed by earthquake and fire. This terrible calamity has demonstrated the fact that steel structures are superior to brick and stone.

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INTERIOR VIEW OF NAPA HOTEL, wrecked by the earthquake, April 18th, 1906.

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HALL OF JUSTICE, the morning of the earthquake, showing the destruction wrought.

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CRACK IN THE EARTH at Golden Gate Park, San Francisco. This crevice was made by the earthquake.

THIS PHOTOGRAPH PICTURES THE COMPLETE DESTRUCTION OF MANY BUILDINGS IN THE HEART OF THE FACTORY DISTRICT, SHOWING THE SWEEP MADE BY THE FLAMES.

SAN FRANCISCO CATASTROPHE—LOOKING WEST ON MARKET STREET FROM KEARNEY—THIRD AND GEARY STS.

VIEW OF PART OF THE IMMENSE DISTRICT THAT WAS DEVASTATED BY FIRE CAUSED BY THE EARTHQUAKE, SHOWING THE BAY IN THE DISTANCE

CHAPTER I.

AWFUL HAVOC BY EARTHQUAKE AND FIRE IN SAN FRANCISCO.

SWIFT as a thunderbolt from a clear sky the appalling calamity fell which devastated the fairest portion of California. Smitten by the hand of God, doubly visited by the awful vengeance of earthquake and of fire, the Queen City of the Pacific lay prostrate on the earth gashed by yawning fissures and still heaving as if in pain, beneath a sky aflame with the reflection of an uncontrollable conflagration.

The population, awakened at the dawn of day by the trembling of the earth—followed by an appalling shock as the foundations of the world gave way—rushing, such as were not crushed beneath their own roofs, half clad to the streets to find walls tottering, streets yawning and fire spreading—the population of San Francisco feared the day of doom had come.

Panic seized the people as they realized that thousands of lives might be lost.

Many square miles in the city's heart were wrecked. Two hundred million dollars' worth of property was lost. Terror reigned, even above sorrow for the dead and the injured and grief for destroyed homes and ruined property, for there is no human sensation like that of feeling the earth no longer stable beneath the feet.

No one was sure that the tremors might not at any moment swell again into annihilating shocks. Thousands were fleeing from the city by every means of egress remaining open. Martial law was declared and troops under General Funston were in control. Streets in every part of town were filled with wreckage, while in the business section south of Market Street the devastation is complete.

Excited crowds watched the flames devour skyscrapers which the day before were the pride of the Pacific Coast. The water mains were broken and little water was available. On every side was heard the explosion of dynamite, employed to stay the devouring march of the flames; the roar of

the conflagration pervaded every part of the city and now and again there seemed to mingle with it the moan of the travailing earth.

An earthquake lasting possibly not many seconds, but the most terrific ever known on this coast, shook the city shortly after five o'clock Wednesday morning, April 18, 1906. Soon after the first shock fires broke out in several places. Then the discovery was made that the water mains had been so injured that there were no streams available. In instances the firehouses had been so damaged that the apparatus could not be gotten out, although it would have been practically useless.

Such was the confusion at this time that no complete list of the dead could be made. The only wire running out of the city was through the Ferry Building, at the foot of Market Street, which still stood, although its high tower leaned at a dangerous angle.

REGULAR TROOPS ON GUARD.

All traffic ceased. Regular troops patroled the streets, with orders to shoot any one found looting. Two hundred thousand persons were homeless and great crowds had gathered in the parks. Either they had lost their homes or were afraid to go back to their houses. Some brought their household goods with them. Mayor Schmitz gave orders that all of these be fed.

Over a scene of desolation unspeakable there hovered a pall of smoke. The district from Eighth Street to the water front, embracing many of the large hotels and lodging houses, and including the south side of Market Street to Folsom, was a blackened waste, swept by fire. Within it stood the Grant, Parrott and Flood Buildings, the first housing the largest department store of the city.

Close to them was the Academy of Sciences.

The Claus Spreckels Building, a towering steeple-like structure of eighteen stories, resisted the earthquake, but became a victim of the flames. The Call Building, a three-story structure in the rear, was gone.

Just across the alley to the south, the Winchester, an eight-story hotel of cheap construction, but with a veneer of brick, burned. It was this that proved the undoing of the Spreckels Building, although it was attacked from the west also. The Examiner Building, across Third from the

Spreckels, collapsed from the shock of the earthquake. It was a flimsy edifice, and from the time of its erection regarded as dangerous.

FLED FROM FLAMES.

Across Market from the Examiner, and diagonally across from the Spreckels Building, stood the Chronicle. It was a dozen stories in height, but escaped the earthquake only to become a prey to the flames. Still farther down Market Street the Palace Hotel was destroyed, but all the guests fled long before the danger had become acute.

The hotel was thirty years old and was built by the late Senator Sharon. The Crocker Building, opposite, escaped with small damage. The Telegraph Building, in which was the office of the Postal Telegraph Co., had to be deserted when portions of it collapsed and the roar of the flames was near.

Below this point the elements showed no favors. On both sides of Market Street they made a clean sweep. Mission, Howard and Folsom, running parallel to Market, were devastated to the water front. Along the water front itself there was a fringe of fire for many blocks, the wharfs at Green and Broadway Streets being destroyed. Between this point and the other end of the bay the blaze was a stretch of at least a mile and a half long.

The Ferry Building was spared the flames by reason of a broad area paved with basalt that cuts it off from the nearest buildings. The Phelan Building, which had been for years the headquarters of the army, and which was one of the most valuable properties in the city, burned like tinder.

The same was true of many others that had been regarded as fireproof, although not of modern construction. It was true also of some of the newer structures—the Rialto, for instance, which stood at the corner of Third and Mission, and was generally accepted as the finest specimen of business architecture.

There were several additional shocks, none severe, but grimly suggestive. The jar of explosions and of falling walls led the frightened people to imagine more shocks than really occurred, but the earth appeared to tremble at intervals, and it was considered unsafe to be high up in any building.

Rumors came in from surrounding towns of damage and deaths, San Jose being down for twenty fatalities and Santa Cruz for a smaller number.

The roar of the flames could be heard even on the hills which were out of the danger zone. Here many thousands congregated and viewed the scene. Great sheets of flame rose high in the heavens, or rushed down narrow streets, joining midway between the sidewalks.

A portion of the City Hall, which cost over $6,000,000, collapsed, the roof sliding into the courtyard, and smaller towers tumbling down. The great dome was moved, but did not fall. The new post office, one of the finest in the United States, was badly shattered, as was the Mint, near it. The latter building was also on fire and was doomed.

The Valencia Hotel, a four-story wooden building, sank into the basement, a pile of splintered timbers, under which were pinned many persons. The basement was full of water and some of the helpless victims were drowned.

While the big wholesale grocery establishment of Wellman, Peck & Co. was on fire from cellar to roof, the heat was so oppressive that passengers from the ferryboats were obliged to keep close to the water's edge in order to get past the burning structure.

The prisoners confined in the city prison on the fifth floor of the Hall of Justice were transferred in irons to the basement of the structure. Later they were removed to the Broadway jail. One of the first orders issued by Chief of Police Dinan was to close every saloon in the city. This step was taken to prevent drink-crazed men from rioting.

DRIVEN MAD BY SCENES.

A. W. Hussey came to the station at the Hall of Justice and told how, at the direction of a policeman whom he did not know, but whose star number he gave as 615, he had cut the arteries in the wrists of a man pinioned under timbers at the St. Katherine Hotel. According to the statement made by Hussey, the man was begging to be killed, and the policeman shot at him, but his aim was defective and the bullet went wide of the mark. The officer then handed Hussey a knife, with instructions to cut the veins in the suffering man's wrists, and Hussey obeyed orders.

Chief of Police Dinan directed that Hussey be locked up. There was

no opportunity to investigate his story, but the police believe that the awful calamity rendered him insane, and that the incident reported to them had no existence excepting in his imagination.

Mayor Schmitz sent out orders that physical necessities of the sufferers be first attended to. Goldberg, Bowen & Co. sent word that they had placed all of their stores at the disposal of the city, including the provisions contained therein.

The fire swept down the streets so rapidly that it was almost impossible to save anything in its way. It reached the Grand Opera House on Mission Street and in a moment had burned through the roof. From the opera house the fire leaped from building to building, leveling them to the ground in quick succession.

Thousands of people watched the flames licking the stone walls of the Spreckels Building. At first no impression was made, but suddenly there was a cracking of glass and an entrance was effected. The inner furnishings of the fourth floor were the first to go. Then, as if by magic, smoke issued from the top of the dome. This was followed by a most spectacular illumination. The round windows of the dome shone like so many full moons; then long waving streamers of flames burst forth.

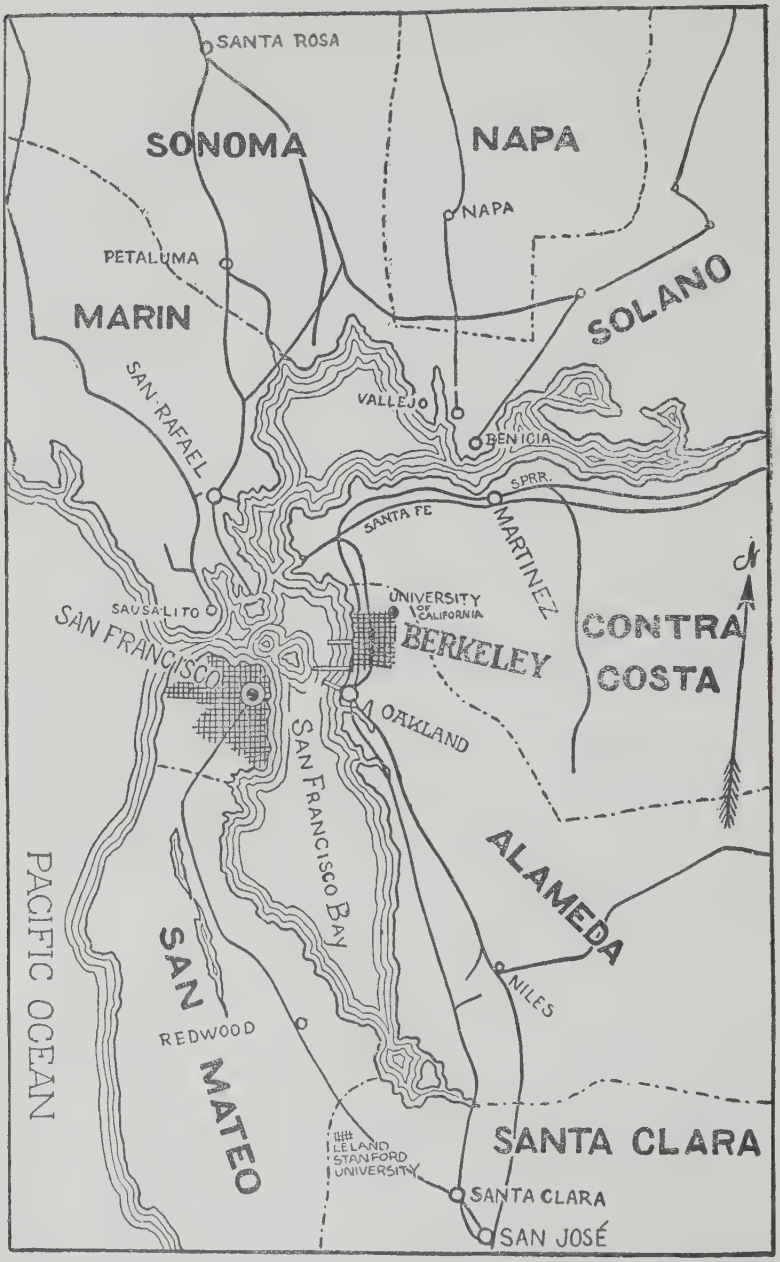
The tall and slender structure, which had withstood the forces of the earth, appeared doomed to fall before the fire. But after a time the light grew less intense, and the flames, finding nothing to consume, died out, leaving the building standing, but completely gutted.

The fifteenth floor was devoted to a restaurant, the sixteenth and seventeenth occupied by the Denver Club.

WOMEN WEEP AT FLAMES.

Women wrung their hands and wept, crying, "It is so terrible."

The position of the operator at the Ferry Building was one of extreme peril, and any message was likely to be the last. There was no chance to verify any story brought in. All that could be said with certainty was that the fire was still awful in its ravages and appalling in the extent of the territory covered, this reaching from the water front to Eighth Street, in a strip varying from four to twelve blocks, with scattered fires in the Mission, a section remote from the centre of the ravages.



MAP OF SAN FRANCISCO AND VICINITY.

The towns named suffered great loss from effects of the earthquake.

Several looters were shot by the soldiers who were patrolling the streets. General Funston issued orders to this effect, and four men caught stealing were summarily shot.

The greatest destruction occurred in that part of the city which was reclaimed from San Francisco Bay. Much of the devastated district was at one time low marshy ground, covered by water at high tide. As the city grew it became necessary to fill in many acres of this low ground in order to reach deep water. The Merchants' Exchange Building, a fourteen-story steel structure, was situated on the edge of this reclaimed ground. It had just been completed, and the executive offices of the Southern Pacific Company occupied the greater part of the building.

RESIDENCE SECTION DOOMED.

The damage by the earthquake to the residence portion of the city, the finest part of which is on Nob Hill and Pacific Heights, seems to have been slight. On Nob Hill are the residences of many of the millionaires who in the early 70's became wealthy through mining investments or the construction of the Central Pacific Railway. They include the Stanfords, Huntingdons, Hopkins, Crockers, Floods and others.

The magnificent Fairmount Hotel stands on the brink of Nob Hill overlooking the bay. The hotel was not seriously damaged by the earthquake, but destroyed by fire. The construction of the hotel was started by Mrs. Herman Oelrichs, of New York, as a monument to her father, Senator James Fair, but she sold it for $3,000,000.

A Committee of Safety was appointed by Mayor Schmitz, and the members were to assist in keeping order and directing relief. The Mayor notified bakers and milk dealers that their stock must be kept for use of the homeless.

While buildings were being blown up with dynamite, premature explosions killed many men. The Terminal Hotel, at the river front on Market Street, fell and buried twenty persons under the debris. All of San Francisco's playhouses, including the Majestic, Columbia, Orpheum and Grand Opera House, are a mass of ruins. The earthquake demolished them for all practical purposes and the fire completed the destruction. The handsome Rialto and Casserly buildings were burned to the ground, as was everything in that district.

The scene at the Mechanics' Pavilion, where the dead and injured were taken, was one of indescribable horror. Sisters, brothers, wives and sweethearts searched eagerly for some missing dear one. Thousands of persons hurriedly went through the building, inspecting cots on which the sufferers lay, in the hope that they would find some loved one who was missing.

FIRE ROUTS HOSPITAL CORPS.

The dead were placed in one portion of the building, and the remainder was devoted to hospital purposes. Later on the fire forced the nurses and physicians to desert the place with their patients, and the eager crowds followed them to the Presidio and the Children's Hospital, where they renewed their search for missing relatives.

The day's experience was a testimonial to the modern steel building. A score of these structures were in course of construction, and not one suffered from the earthquake shock. The completed modern buildings were also virtually immune from harm from the seismic movements. The damage by earthquake did not compare with the loss by fire.

The freaks of the earthquake were many. Wide fissures were made in the streets, street railways were twisted out of line, sewers and water pipes were burst, and it was feared that there would be an epidemic of disease. Provisions were sold at fancy prices, and even water was vended by the glass.

At a meeting of the Committee of Safety, Mayor Schmitz issued the following proclamation:

"The Federal troops which are now policing a portion of the city, as well as the regular and special members of the police force, have been authorized by me to kill any persons whomsoever found engaged in looting the effects of any citizen or otherwise engaged in the commission of crime.

"Under these circumstances I request that all citizens whose business does not imperatively require their absence from home after dark remain at home during the night time until order shall have been restored. I beg to warn all citizens of the danger of fire on account of defective or destroyed chimneys, gas pipes, gas fixtures and the like."

At 5 o'clock at night the firemen were as far as ever from checking

the progress of the flames. In the northern part of the downtown business section the fire swept around the Hall of Justice and communicated to Chinatown, thence proceeding westward into the heart of that colony. It then began rapidly eating its way southward on both sides of Kearney Street, and at 7 P. M. was within a block of the California Hotel. This point is near the plant of the *Evening Bulletin,* in which the three morning papers had agreed to join to issue a four-sheet paper in the morning. That plan was abandoned, as the *Bulletin* lay directly in the path of the flames.

One of the big losses of the day was the destruction of St. Ignatius's Church and College, at Van Ness Avenue and Hayes Street. This was the greatest Jesuit institution in the West, and was built at a cost of a couple of millions.

At 7 o'clock the fire had swept from the south side of the town across Market Street into the western addition, and was burning houses at Golden Gate Avenue and Octavia Street. This result was reached after almost the entire southern district from Ninth Street to the eastern water front had been converted into a blackened waste. In this quarter were hundreds of factories, wholesale houses and many business firms, in addition to thousands of homes.

MAYOR ROUTED BY FIRE.

Temporary headquarters were established in tents in Portmouth Square for Mayor Schmitz, Chief of Police Dinen and General Funston, but this site became too dangerous about 6 o'clock and was abandoned. Later the flames swept the square. In the south side district on Rincon Hill, St. Mary's Hospital, a landmark, conducted by the Sisters of Mercy, was reduced to ashes.

Throughout the city, wherever there was a public square, a scene of desolation was presented. Tents were pitched by fortunate possessors of canvas, but most of the homeless people were huddled in frightened groups about the household belongings they managed to save from the general ruin.

Despite the heroic work of the firemen and the troops of dynamiters, who razed building after building, and blew up property valued at millions,

the flames spread across Market Street to the north side, and swept up Montgomery Street, almost to Washington Street. Along Montgomery Street are some of the richest banks and commercial houses in San Francisco. The Mutual Life Insurance Building and scores of bank and office buildings were on fire, while blocks of other houses were in the path of the flames, and nothing seemed to be at hand to stay their progress. Block after block of banking houses were now masses of red-hot ruin.

KNEEL IN PRAYER ON PAVEMENT.

The pastor of St. Francis's Church, on the slope of Telegraph Hill, a few blocks from the raging furnace, gathered his flock about him on the sidewalk, where all knelt in prayer. There was neither gas nor electric light in San Francisco at night. The plant of one of the gas companies blew up in the morning, and as a measure of precaution all the other gas in the city was turned off.

From Golden Gate Park came news of the total destruction of the immense building covering a portion of the children's playground. The pillars of the new stone gates at the park entrances were twisted and torn from their foundations. Some of them, weighing nearly four tons, were shifted as though they were constructed of cork.

In Union Square Park the mighty Dewey monument was shifted from its base and stood leaning at an angle of 10 degrees.

Prof. George Davidson, of the University of California, formerly connected with the United States Geodetic Survey, said:

"The earthquake came from north to south, and the only description I am able to give of its effect is that it seemed like a terrier shaking a rat. I was in bed, but was awakened at the first shock. I began to count the seconds as I went toward the table where my watch was, being able through much practice closely to approximate the time in that manner. The shock came at 5.12 o'clock.

"There were two slight shocks afterward. At 8.14 o'clock I recorded a shock of five seconds' duration and one at 4.15 of two seconds. There were slight shocks which I did not record at 5.17 and 5.27. At 6.50 P. M. there was a sharp shock of several seconds."

It was long the aim of Leland Stanford, builder of great railroads,

United States Senator and Governor of the State of California, to establish a mighty educational institution for the perpetuation of his name. And when, in 1885, his only son, Leland Stanford, Jr., died, Senator Stanford and his wife determined to undertake at once the establishment of the university so long in contemplation.

For an example of such public service they had before them the University of California at Berkeley, which owed a large part of its endowment, if not its very claim to continuing existence, to the generosity of another family which had made its millions in the development of railroad facilities, for Mrs. Phœbe Herst had already determined to devote a large part of her great fortune to the elder institution.

Palo Alto, in the heart of the Santa Clara Valley, was chosen for the site, and work, started soon after the death of the younger Stanford, was pushed with a celerity that enabled the opening of the institution before the decade had closed.

BUILT TO RESIST EARTHQUAKES.

It is of peculiar interest at this time that the plan of the buildings of Leland Stanford, Jr., University contemplated a type which was thought to be well able to resist earthquake shock. None of the structures around the great quadrangle was raised more than a story in height, the general style of architecture being that of the old mission buildings which remained throughout California as relics of an earlier age.

The asphalted court, or quadrangle, was 586 feet long and 246 wide, and contained more than three acres of space. To the beautification of the establishment some of the most celebrated artists of the world were called, among them St. Gaudens, who personally designed and superintended the erection of some of the massive gateways that led into the inner courts.

Stanford University grew fast. By 1899 it had 1400 students, 500 of them girls, and in six years its membership grew to over 2000 students all told. After the death of Senator Stanford, in 1893, Mrs. Stanford devoted virtually her entire time to the institution, having so close a watch over its departments and instruction, indeed, that at times there was trouble in its teaching corps as a result of her activities. David Starr

Jordan has been the very efficient president of the university since 1891.

Palo Alto is thirty-three miles south of San Francisco, on the coast line of the Southern Pacific Railroad. The university was endowed to the extent of nearly $30,000,000. The university buildings are built of brownstone, and said to be the finest cluster of buildings used for educational purposes in this country. The memorial chapel, which is situated in the center of the group of buildings, was built at a cost of more than $3,000,000.

The town of Palo Alto has a population of about 5000, and the country for a radius of several miles is level.

GREAT EARTHQUAKES OF THE LAST TWENTY YEARS.

June 10, 1886—Tarawera, New Zealand. Earthquake and volcanic eruption. Many persons perished.

August 31, 1886—Earthquake shock felt throughout nearly the entire portion of the United States east of the Mississippi River, the shocks being experienced from the Gulf northward to the upper lakes and from points near the Mississippi eastward to the Atlantic Coast. The shock was particularly severe at points in the South, and in Charleston, Savannah, Augusta and nearby places the shock was repeated. Charleston was the center of the disturbance and suffered the greatest damage. A number of the houses in that city were either entirely demolished or rendered unfit for occupancy. The losses ran into millions and thirty-five lives were lost. Shocks returned at intervals throughout the entire months of September, October and November. From August 28th to September 30th no less than thirty shocks were recorded; during October, twenty-eight, and during November, fourteen. Many of the disturbances recorded, however, were so slight as to be hardly noticeable.

May 3, 1887—Mexico. Earthquake and volcanic eruption; thirteen killed.

December, 1887—Yunnan, China; 5,000 killed. Lo-Chan, China, 10,000 killed.

March 10, 1888—Yellow River, China. Flood and earthquake; 100,000 killed.

July 30, 1889—Japan. Many lives lost.

October 28, 1891—Japan; 6500 killed.

January 28, 1894—Persia; 12,000 killed.

April 23, 1894—Greece, 227 killed.

May 9, 1894—Venezuela; 11,000 killed.

July 10, 1894—Constantinople; 1000 killed

January 17, 1902—Mexico; 300 killed.

September 25, 1902—Turkestan, 667 killed.

January 22-27, 1903—State of Chihuahua, Mexico. Four shocks were felt, eighteen houses wrecked and the entire population became panic-stricken.

February 8, 1903—United States. Shocks startled Illinois, Missouri and Kentucky. Little damage was done. Southern Illinois and Eastern Missouri were much disturbed by two severe shocks, which caused chimneys to topple over, stopped clocks, broke windows and sent the people fleeing in terror. At Owensboro, Ky., the shocks were quite severe and many buildings were damaged. On the same day earthquake shocks were felt at Brest, St. Breuc and on the island of Moleve, in France.

March 30, 1903—Jerusalem. Shock of unprecedented violence. The people were panic-stricken, but damage slight.

April 4, 1905—Seven shocks were felt in the Valley of Kangra, India, causing severe destruction and suffering.

September 8, 1905—Province of Calabra, Italy. Very destructive.

CHAPTER II.

SAN FRANCISCO'S FINE RESIDENCES IN FLAMES AND WHOLE BUSINESS SECTION DESTROYED.

SUCH was the news that appalled the world on the afternoon of April 19th. The startling despatch was as follows:

"The great conflagration is sweeping through the residential section of San Francisco. Flames have reached the Fairmount Hotel, on Nob Hill, and are rapidly encroaching upon the homes of the Crockers, the Huntingtons and other wealthy Californians in that aristocratic portion of the city. Every business building in the city has been destroyed.

"The water supply, which was crippled by the earthquake shocks, has been completely shut off, and there is no water to fight the fire. To add to the desperate situation, explosives used to blow up buildings in the fire's path are becoming exhausted.

"The city at latest accounts is doomed to destruction by fire. There is no possible means now to check the course of the flames, and they will probably burn until there is nothing left for them to feed upon.

"Nothing now remains of the business section of the city but a dreary waste of smouldering ruins. The fire has already burned its way over an area of ten square miles.

"From the interior of the State come the most alarming reports. Santa Rosa, one of the prettiest cities, is a total wreck. The loss of life has not been estimated. It will reach thousands. There are 10,000 homeless men, women and children huddled in the open spaces of that city. The whole business portion of the town seemed to crumble into ruins with the earthquake shock. What was not destroyed by seismic violence was obliterated by flames.

INSANE ASYLUM DEMOLISHED.

"In San Jose and Oakland the havoc was fearful. Agnew's Insane Asylum was demolished by the shock, and many of the inmates were buried in the ruins. Those who escaped death or injury fled and are roaming about the stricken country.

"A late Western Union dispatch says the section surrounding the spot upon which the building of that company stood is in a mass of flames. The burning territory is surrounded by United States troops.

"The fears of the inhabitants of Oakland were intensified by another sharp earthquake shock, which lasted about five seconds. This shock was felt in San Francisco, and buildings are reported to have been shaken down.

"The United States Mint, which contained $39,000,000 of coin and bullion, escaped destruction, although all around it buildings were burned to the ground. The employees of the mint battled with the encroaching flames for hours, and often at the risk of their lives.

"In spite of the vigilance of the police and the United States troops, who are patrolling the burned and burning section, thieves and vandals worked. The shooting of three fiends caught in the act of robbing the dead had a tendency to check pillage and theft, but failed to stop it."

Of the scenes which marked the transformation of this the gayest, most careless city on the continent, into a wreck and a hell, it is hard to write. That the day started with a blind, general panic goes without saying. People woke with a start to find themselves flung on the floor. In such an earthquake as this it is the human instinct to get out of doors, away from falling walls. The people stumbled across the floors of their heaving houses to find that even the good earth upon which they placed their reliance was swaying and rising and falling so that the sidewalks cracked and great rents opened in the ground.

ROAR IN THE AIR LIKE THUNDER.

The three minutes which followed were an eternity of terror. Probably a dozen or more persons died of pure fright in that three minutes, when there seemed no help in earth or heaven. There was a roar in the air like a great burst of thunder, and from all about came the crash of falling walls. It died down at last, leaving the earth quaking and quivering like jelly. Men would run forward, stop as another shock, which might be greater any moment, seemed to take the earth from under their feet, and throw themselves face downward on the ground in an agony of fear.

It seemed to be two or three minutes after the great shock was over

before people found their voices. Then followed the screaming of women beside themselves with terror, and the cries of men. With an impulse people made for the parks, as far as possible from the falling walls. These speedily became packed with people in their nightclothes, who screamed and moaned at the little shocks which followed every few minutes. The dawn was just breaking. The gas and electric mains were gone, and the street lamps were all out. But before the dawn was white there came a light from the east—the burning warehouse district. The braver men, and those without families to watch over, struck out, half dressed as they were. In the early morning light they could see the business district below them, all ruins and burning in five or six places. Through the streets from every direction came the fire engines, called from all the outlying districts by the general alarm rung in by the assistants of the dead chief.

PANIC IN PORTSMOUTH SQUARE.

On Portsmouth Square the panic was beyond description. This, the old Plaza about which the early city was built, is bordered now by Chinatown, by the Italian district, and by the "Barbary Coast," a lower tenderloin. A spur of the quake ran up the hill upon which Chinatown is situated and shook down part of the crazy little buildings on the southern edge. It tore down, too, some of the Italian tenements. The rush to Portsmouth Square went on almost unchecked by the police, who had more business elsewhere.

The Chinese came out of their underground burrows like rats and tumbled into the square, beating such gongs and playing such noisy instruments as they had snatched up. They were met on the other side by the refugees of the Italian quarter. The panic became a madness. At least two Chinamen were taken to the morgue dead of knife wounds, given for no other reason, it seems, than the madness of panic.

There are 10,000 Chinese in the quarter, and there are thousands of Italians, Spaniards and Mexicans on the other side. It seemed as though every one of these, with the riffraff of "Barbary Coast," made for that one block of open land. The two uncontrolled streams met in the center of the square and piled upon the edges. There they fought all the morning, until the regulars restored order with their bayonets.

As the dawn broke and the lower city began to be overhung with the smoke of burning buildings, there came a back eddy. Cabmen, drivers of express wagons and trucks, hired at enormous prices, began carting away from the lower city the valuables of the hotels which saw their doom in the fires which were breaking out. Even the banks began to take out their bullion and securities and, under guard of half-dressed clerks, to send them to the hills, whence came to-day the salvation of San Francisco.

VANDALS GET TO WORK.

One old nighthawk cab, driven by a cabman white with terror, carried more than a million dollars in currency and securities. Men, pulling corpses or injured people from fallen buildings, stopped to curse these processions as they passed. Time and again a line of wagons and cabs would run against an impassable barrier of debris, where some building had fallen into the street, and would pile up until the guards cleared a way through the streets.

Then the vandals formed and went to work. Routed out from the dens along the wharves, the rats of San Francisco waterfront, the drifters who have reached the back eddy of European civilization, crawled out and began to plunder. Early in the day a policeman caught one of these men creeping through the window of a small bank on Montgomery Street and shot him dead. But the police were keeping fire lines, beating back over-zealous rescuers from the fallen houses and the burning blocks, and for a time these men plundered at will.

News of the plundering was carried early to Mayor Schmitz. It was this as much as anything which determined him, when General Funston came over on the double-quick, with the whole garrison of the Presidio, to put the city under martial law. Orders were issued to the troops to shoot anyone caught in the act of looting, and the same orders were issued to the First Regiment, National Guard of California, when it was mustered and called out later in the day.

And all this time, and clear up until noon, the earth was shaking with little tremors, many of which brought down walls and chimneys. At each of these the rescuers, even the firemen, would stop for a moment paralyzed.

The 8 o'clock shock, the heaviest after the big one, drove even those who had determined to stay by the stricken city to look for a means of escape by water. There are only two ways out of San Francisco; one is by rail to the south and down the Santa Clara Valley, the other is by water to Oakland, the Overland terminal. Most of the Californians trying to get out of the quaking, dangerous city made by instinct for the ferry, since they knew that the shocks always travel heavily to the south, down the Santa Clara Valley.

As for the Easterners, they had come by ferry and they started to get out by ferry. But when the half-dressed people, carrying the ridiculous bundles snatched up in time of panic, reached Montgomery Street, they found they way stopped by ten blocks of fire. They piled up on the edge of this district, fighting with the police, who held them back and turned them again toward the hills. They must stay in the city. If it went, they went with it.

TROOPS STOP FLIGHT.

The troops ended their last hope of getting out of town. So great had been the disorder that as afternoon came on and the earth seemed to be quieting down, they enforced strict laws against movement. This stopped a strange feature of the disaster—a run on the banks by people who wanted to get out their money and go. All the morning lines of disheveled men had been standing before the banks on Montgomery and Sansome Streets, ignoring the smoke and flying brands and beating on the doors. The troops drove these away, and the banks went on with their work of getting out the valuables.

There is an open park opposite City Hall. Here, in default of a building, the Board of Supervisors met and formed, together with fifty substantial citizens whom they had gathered together, a committee of safety. They also set themselves to the problem of quarters for the dying and the dead.

Strangely enough, Mechanics' Pavilion, across from the City Hall, had escaped, although it is only a wooden building. But it has the largest floor in San Francisco, and it was pressed into service at once. The police and the troops, working admirably together, passed the word

that the dead and injured should be brought there, since the hospitals and morgue had become choked, and toward that point, in the early forenoon, the drays, express wagons and hacks, impressed as temporary ambulances, took their course.

There were perhaps 400 injured people, many of them terribly mangled, laid out on the floor before noon. Nearly every physician in the city volunteered, and they got together enough trained nurses to do the work. There were fewer corpses; too busy were the forces of order in stopping the conflagration and caring for the living to care for the dead. One of the first wagons to arrive, however, brought a whole family—father, mother and three children—all dead except the baby, who had a terrible cut across the forehead and a broken arm. These had been dragged out from the ruins of their house on the water front.

WORKINGMEN KILLED BY FALL OF BUILDING.

A large consignment of bodies, mostly of workingmen, came from a small hotel on Eddy Street, through whose roof there fell the entire upper structure of a tall building next door. It made kindling wood of the two upper floors of the lodging house, which itself stood. Men from the neighboring houses, running along the streets, heard the cries and groans from this house and ran in. They reached the second floor, and through a hole in the ceiling there tumbled a man, horribly mangled about the head, who lay where he had fallen and died at their feet.

Then there is a story, one of the almost incredible horrors to which we have listened all day, brought to the central police station by a man named Hussey. He told how he found in a burning building a man pinioned by the wreck and already scorched by the flames; how this man begged of a policeman who stood by for release from his misery, and how the policeman fired and missed. Then Hussey took a knife and severed an artery in the wrist of the sufferer, who bled to death. Hussey talked rationally, but the police locked him up until they can investigate.

Later and unconfirmed news from the wreck of the Valencia Hotel says that the ground fairly sucked it in. The basement was full of water, so that when the rescue corps got through the debris they found the bodies floating about, apparently as many drowned as crushed. They tell of

people thrown from windows and killed on the pavements below by the first great shake, of people crushed in the streets by the debris which fell from the upper stories of buildings. The people were so sickened by horror that they were willing to believe anything.

As the day wore and the wind changed, the fire along the water front burned itself out and ran on further down south of Market street. This gave a comparatively clear passage to the ferry building, and the troops permitted genuine refugees to pass to the Southern Pacific ferries, which were loaded down with people, many of them still half dressed. At nightfall the troops cut off this privilege, probably for fear of rioting and disorder.

PANIC-STRICKEN PEOPLE FLEEING FOR SAFETY.

Thousands of homeless and panic-stricken people were leaving the city and seeking shelter in Oakland and other suburban towns. The suffering and hardship were great. Countless numbers of residents of the poorer part of the city, including Chinese, Japanese and Italian quarters, were rendered homeless. Never has the fate of a city been more disastrous.

For three miles along the water front buildings were swept clean, and the blackened beams and great skeletons of factories and offices stood silhouetted against a background of flame that was slowly spreading over the entire city. The whole commercial and office quarter on the north side of Market Street to Tenth Street was consumed in the flames, while hardly a building was standing in the district south of Market Street. Despite the heroic work of the firemen and the troops of dynamiters, who razed building after building and blew up property valued at millions, the flames spread across Market Street to the north side and swept up Montgomery Street, almost to Washington Street.

Along Montgomery Street are some of the richest banks and commercial houses in San Francisco. The famous Mills Building and the new Merchants' Exchange, in which is situated the Marine and Stock Exchanges, were still standing, but the Mutual Life Insurance Building and scores of bank and office buildings were on fire, while blocks of other houses were in the path of the flames, and nothing seemed to be at hand to stay their progress.

The earthquake caused the partial wreck of the California Hotel, at Bush and Kearney Streets, and the falling chimney and cornice of the hotel crashed through the fire house adjoining, severely injuring Fire Chief Sullivan so that he was unable to direct the work of fire fighting.

Despite this disheartening accident, the entire fire department, assisted by part of the Oakland department and many volunteers from outside districts, did heroic service, many brave men losing their lives while performing the work of succor. The earthquake, however, had broken most of the water mains, and the men were without water to battle with the fire. Whatever water was obtained to fight the flames in the harbor front and in the factory districts was pumped from the bay. This compelled dynamiting as the only possible method of saving any of the city.

BIG HOTELS AND FACTORIES WIPED OUT.

The flames were kept confined to the south of Market Street in the business section until about 3 o'clock in the afternoon, when the wind carried sheets of flame into the richest part of the city.

Nothing except the gutted framework of the Palace Hotel, 1000 rooms, stands.

The $2,000,000 Fairmount Hotel is still standing. It suffered little damage. The Odd Fellows' Temple, in Market street, the St. Nicholas and the Call and the Examiner buildings and the Parrott building are gone, while the City Hall caved in when the earthquake shook the city,

Nearly every big factory building has been wiped out, and a complete enumeration of them would look like a copy of the city directory. Many of the finest buildings in the city were leveled to dust by terrific charges of dynamite in an ineffectual effort to stay the fire. In this work many heroic soldiers, policemen and firemen were maimed or killed outright.

At night the city resembled one vast shambles, with the red glare of the fire throwing weird shadows across the worn and panic-stricken faces of the homeless wandering the streets or sleeping on piles of mattresses and clothing in the parks and on the sidewalks in those districts not yet reached by the fire. Thousands fled the city, forgetting for a moment the terrible suffering, physical and financial, that trails in the wake of the

disaster, and the scene presented by the flames was one of unspeakable grandeur.

Looking over the city from a high hill in the western section, the flames could be seen rolling skyward for miles and miles, while in the midst of the spitting red tongues of fire could be seen the black skeletons and falling towers of doomed buildings. At regular intervals the booming of dynamite told of the work of the brave men attempting to save the city from annihilation.

A falling wall from one of the dynamited buildings on Mission Street crushed out the life of Fireman Max Fenner, while many other fire-fighters met a like fate. Through all the streets ambulances and express wagons were hurrying, carrying dead and injured to morgues and hospitals.

DEAD LEFT TO CREMATION.

At the morgue in the Hall of Justice fifty bodies were lying. The flames rapidly approached this building, and the work of removing the bodies to Jackson Square, opposite, began. While the soldiers and police were carrying the dead to what appeared safe places, a shower of bricks from a building dynamited to check the flames injured many of the workmen and sent soldiers in procession hurrying to hospitals. The work of removing the bodies stopped, and the remainder of the dead were left to possible cremation in the morgue.

The city was under stringent martial law, and squads of cavalry and troops of infantry were patrolling the streets and guarding the sections that were not yet touched by the flames. Despite their efforts to keep the crowds from the section being dynamited, many persons slipped through the guards, and not a few suffered for their temerity.

From the Barbary Coast the horde of vicious and criminal that infest that quarter poured forth and started early in the evening to loot stores and rob the dead. Fearing such a fiendish climax to this day of horrors, Mayor Schmitz and Police Chief Dinan issued orders for the soldiers to kill all who engaged in such work. Before the eyes of an Associated Press representative three thieves were shot in the back and fatally wounded in the burning commercial district.

The earthquake worked astonishing havoc in San Francisco's famous

Chinatown. Chinese theatres and joss houses are in ruins, and rookery after rookery collapsed, covering alive hundreds of Chinese. Panic reigned among the thousands of Chinese, and they filled the streets, dragging in whatever they could save.

The Japanese quarter was burned. The people fled in terror, packing on their backs what household effects they could tie together. Thousands of men, women and children from the Latin quarter quit the throng when darkness began to fall, and marched in endless procession towards the hills or to the water front, frantic to get away from the city lest other earthquakes follow and the flames trap them before they could make their escape.

At 9 o'clock an Associated Press man who went to a high hill overlooking the city noted that the sky on the east and south sides was illuminated for a distance of four or five miles. The illumination on the southern side was of a duller glow, showing that the flames were not consuming property of such great proportions as was the case on the east side.

SOME OF THE CHOICEST BUILDINGS BURNED.

In the business district towards the water front the flames were either checked or blocked at about Washington Street, and at the corner of Kearney Street the Hall of Justice could be noted standing, but it was impossible to determine what damage had been done to the interior. From the Hall of Justice to the south the fire cut its way through some of the choicest buildings in the city, the Pacific Mutual and the Italian-American banks being reduced to ashes. Down Kearney Street on both sides at 10 o'clock the conflagration was still raging with fury, but the direction of the wind prevented its advance up the hills to the west towards the residence quarter. Yet the greater portion of the structures to the west of Kearney up to Dupont were burned as far south as California.

All around the new Merchants' Exchange Building the fire burned fiercely, licking the sides of the steel giant, but it resisted the influence of the heat. Then came the destruction of the Western Union Building, at the corner of Pine and Montgomery Streets. In this building was the office of the Associated Press. Earlier in the day the occupants had been ordered out by the authorities on account of danger, and the Associated

Press established a temporary station in the Bulletin editorial rooms. Then the latter place was closed, and this was written on a doorstep near Chinatown, the illumination of the burning buildings furnishing light for the writer.

THE CITY FAIRLY ORDERLY.

The city, in the face of its appalling disaster, was fairly quiet and orderly. Liquor could not be had anywhere, and the formidable presence of Federal troops, militia and naval reserves had its effect on an element that might be disposed to be disorderly.

At Mechanics' Pavilion scenes of heroism and later of panic were enacted. The great frame building was turned into a hospital, with a corps of fifty physicians. Nurses volunteered, and the Red Cross ship from the Government yards at Mare Island contributed doctors and supplies. Late in the afternoon, while the ambulances and automobiles were unloading wounded at the building, the march of the conflagration up Market Street gave warning that the injured would have to be removed at once. Every available vehicle was pressed into service to get the stricken into hospitals and private houses of the western addition. A few minutes after the last of the wounded had been carried through the door, fire shot from the roof and the structure burst into a whirlwind of flame.

Down on the harbor front the earth seems to have sunk from six to eight inches, and great cracks appear in the streets. These cracks were twisted into all shapes, and buildings before they were destroyed by fire were seen to be out of plumb. The flames shot in sheets across the streets, and street cars and Southern Pacific rolling stock were burned to the truck wheels. The following is a vivid account by an eye-witness:

The day of awful disaster was followed by a night of terror—a black night of terror—for the city was in darkness, save where the crushed and ruined heart of the city flared red with fire.

In the glare of this red light, as it shot down the streets beyond the ruined district, walked the little files of soldiers, policemen and citizens, each little file bearing the ghastly burden of a disfigured corpse to the huge Mechanics' Pavilion, now turned to a mammoth morgue. Six hundred

crushed human forms and countless hundred wounded, moaning creatures, in whom life still lingered, were borne to this big hall.

Armies in exodus filled all the roads last night. They fled the city in all manner of vehicles. Hysterical cries of terror and distress sounded every little while.

The burning water front made a huge torch, turning the bay into a red lake and flaming upon the ferryboats, crowded to the danger limit, bearing refugees from the demolished, burning city to the safety camps of Oakland.

DYNAMITE FREELY USED.

The soldiers and the police had a fierce fight to keep the avenues to the big ferry pier passable. Time and again they used dynamite to blow away buildings that might feed the fire. The streets approaching the ferry were at times valleys of fire. It did not lick its way to the ferry piers, because a broad boulevard between kept the flames at a distance.

It was during lulls in the high roaring of the fire that the terror-stricken crowds rushed madly through the streets and reached the ferry slips safely. The panic grew more intense hourly, for hourly the thousands huddled on the roofs in the residential districts saw red tongues shoot up in new places, signaling another defeat of the fire-fighters and a greater danger of the complete obliteration of the city.

When the fire did not glare the city was wrapped in a thick, stifling cloak of smoke. It was constantly thickening. One could hardly breathe, even, in the outskirts of the city. The stinging smoke had routed hundreds of the fire-fighters. It sent soldiers, policemen, firemen and other volunteers reeling away toward any place near the water front where they could get a gasp of fresh air and lave their blinded, stinging eyes.

Added to the plague of smoke was the stench of leaking gas mains—sickening, overpowering, pervading every street in the city. In the burning district the gas mains were shooting up geysers of flames, roaring among the red ruins.

Panic could not be checked under such conditions. It was no wonder that frenzy and fright had seized upon the people and sent them rushing, struggling and fighting along all the avenues of escape. Mission Road,

San Mateo and Port Lobos Roads were crowded with an endless procession. And, though these roads lead down by the shore, and though the fear was keen and uppermost that the great earthquake might be followed by a tidal wave that would roar across the city, yet the people must choose to risk this probable danger to escape the deadly dangers that already exist.

They were flying, too, from the famine of water and food that plunged the stricken city into new agonies, for the assistance at first was not commensurate with the great demand.

FEVER OF FLIGHT UNCHECKED.

The fever of flight and panic was beyond all control. There were great nervous throngs around such railroad stations as were not encompassed by flames. Most of the lines were crippled in spots beyond the city, the huge rails in places tied in knots by the irresistible power of the quaking earth. Many were taken in tugs and ferry boats past Oakland and up the Sacramento River to Vallejo, for between Oakland and Vallejo three miles of tracks, cross ties and all, were swallowed by the gaping of the ground.

I have seen this whole, great horror. I stood, with two others, on the corner of Market Street, waiting for a car. Sunlight was coming out of the early morning mist. It spread its brightness on the roofs of the skyscrapers, on the domes and spires of churches, and blazed along up the wide street with its countless banks and stores, its restaurants and cafes.

In the very early morning the city was almost noiseless. Occasionally a newspaper wagon clattered up the street or a milk wagon rumbled along. One of my companions had told a funny story. We were laughing at it. We stopped—the laugh unfinished on our lips.

Of a sudden we had found ourselves staggering and reeling. It was as if the earth was slipping gently from under our feet. Then came a sickening swaying of the earth that threw us flat upon our faces. We struggled in the street. We could not get on our feet.

I looked in a dazed fashion around me. I saw for an instant the big buildings in what looked like a crazy dance.

Then it seemed as though my head were split with the roar that crashed into my ears. Big buildings were crumbling as one might crush

a biscuit in one's hand. Great gray clouds of dust shot up with flying timbers and storms of masonry rained into the street. Wild, high jangles of smashing glass cut a sharp note into the frightful roaring. Ahead of me a great stone cornice crushed a man as if he were a maggot—a laborer in overalls on his way to the Union Iron Works, with a dinner pail on his arm.

Everywhere men were on all fours in the street, like crawling bugs. Still the sickening, dreadful swaying of the earth continued. It seemed a quarter of an hour before it stopped. As a matter of fact, it lasted about three minutes.

Footing grew firm again, but hardly were we on our feet before we were sent reeling again by repeated shocks, but they were milder. Clinging to something, one could stand.

HORRIBLE CHORUS OF AGONY.

The dust clouds were gone. It was quite dark, like twilight. But I saw trolley tracks uprooted, twisted fantastically. I saw wide wounds in the street. Water flooded out of one. A deadly odor of gas from a broken main swept out of the other. Telegraph poles were rocked like matches. A wild tangle of wires was in the street. Some of the wires wriggled and shot blue sparks.

From the south of us, faint, but all too clear, came a horrible chorus of human cries of agony. Down there in a ramshackle section of the city the wretched houses had fallen in upon the sleeping families. Down there throughout the day a fire burned the great part of whose fuel it is too gruesome a ting to contemplate.

That was what came next—the fire. It shot up everywhere. The fierce wave of destruction had carried a flaming torch with it—agony, death and a flaming torch. It was just as if some fire demon was rushing from place to place with such a torch. Flames streamed out of half-shattered buildings all along broad Market Street.

I must confess to bewilderment—to a sort of queer calm in which I hardly noticed anything. And then things grew clear. My two companions and myself stumbled over debris and crawled over it to the *Examiner* office, at Market and Third Streets.

A tangle of broken wires was about the building. We could not enter it. We made our way into Market Street. We came upon the ruins of a lodging house. We worked with others. We dragged and pulled debris off men who had been crushed to death. We found three living ones. We carried them into the street.

Fire was sweeping everywhere. The clanging of the fire apparatus dashing into the heart of the disaster sounded ceaselessly.

Amid death and destruction a splendid spirit of heroism was born among the fortunateswho had escaped. They appeared from all directions —on foot, in automobiles, in cabs—doctors, rich men, poor men, strong men and frail men eager to do what they could to rescue the wounded and save the dead from being burned beyond recognition in the ruins.

From the southern section of the city—from the ramshackle houses where the carnage was frightful—half-clad children and women and men came running, crying shrilly in their terror. The foreheads of some of them showed red wounds. Some fell in dead swoons. Children made motherless in the night clung to strange women for protection.

The disaster was too vast for quick realization. It took time for full comprehension—for the complete picture of the horror to take form in one's brain.

There was the noblest part of the city destroyed—its fine buildings smashed or tottering, or, if they still stood firmly after the giant wrench at their foundations, there was the new element of fire darting, circling and sneaking upon them.

And worst of all, under the smoking mounds hundreds and hundreds of dead, and some, it was well realized, were still living, but buried beyond finding and absolutely doomed.

DYNAMITING BEGINS.

The police, the firemen, the citizen volunteers, were out in droves. But they were almost helpless. They stood in chagrin before the hydrant. The broken water mains mocked the men. They could draw no water from the hydrants.

The situation was one of bitter irony. Destruction had to be fought with destruction. There was nothing to do but get dynamite to work.

To set off great blasts in the path of the flames and thus open gaps over which the fire might not leap. But the fire did sail over such gaps time and time again.

Mayor Schmitz sent a call for aid to Oakland. Its firemen came. He sent a call for aid to the United States soldiers at the Presidio. Washington had already heard of the disaster and General Funston and his two regiments of soldiers marched into the city. They picketed the streets. They formed guards about the banks where treasures were stored. They formed guards about the collapsed Valencia Hotel and other buildings, where the dead were lying. In their rifles they carried death for the ghouls that might try to prowl among the dead victims of the catastrophe.

All through the day it was much like night on account of the smoke.

In the midst of the siege of fire were the Postal Telegraph and Western Union Buildings. The telegraph operators were heroes—diffident heroes. They simply stuck to their posts smiling. They were very prompt to say that they would not leave the buildings until the last wire had gone down. This happened quickly to the Western Union.

ONLY ONE LONG DISTANCE WIRE.

I made my way to the Postal Telegraph Building. I went upstairs littered with broken glass and fragments of wood. I got into an office littered with debris. But three men were at the telegraph keys. Two of them looked up and then stood. Those two wires were gone.

But a third operator signalled me. His wire was still working. It was the only long-distance wire over which the news could be flashed to New York and Philadelphia and the other great centres of the world.

As I stood beside him the third shock came. It was three hours after the big, destructive shock. The Postal Building swayed. Glasses cracked. A constant trembling went on. We could but expect that every next minute would find us crushed in the fallen building. It was swaying, creaking and cracking. But the operator regarded his work as a solemn duty. He stuck to his post.

Suddenly a corps of firemen and police entered the room. They drove us into the street. The spread of the fire, they declared, demanded the dynamiting of the handsome Postal Building.

A little later the detonation sounded. The Postal Building was a mound. The last long wire was down.

The stratagem proved useless. The fire terror spread. It was relentless. Now the next day, it leers luridly, broader and lighter than ever, lashed to a dancing fury by a strong south wind. The awful red wound in the city grows larger and larger.

The fire had lapped its way through the streets of poverty and the streets of commerce to the water's edge. It set the ships speeding out into the harbor to escape destruction. It stripped the city of its fine hotels, its theatres and many of its other most important buildings.

Where the smoke is not too stifling thick the hunt goes on for the wounded and the dead. The little files of those bearing the victims never cease to arrive at Mechanics' Pavilion and depart on new quests night and day, and all in front of the Pavilion agonized creatures begged for news of loved ones, but none could give them, and inside the big Pavilion, on its broad floor and in its galleries, were sights of horrible death and the sounds of human misery too awful for a man to look upon.

KILLED BY EARTHQUAKES.

Since 1137, when the first reliable records apparently were made of such disasters, 1,096,000 persons have lost their lives by earthquakes. This total does not include the destruction wrought by kindred catastrophies like the burial of Pompeii and Herculaneum.

In periods earlier than the twelfth century the losses were doubtless correspondingly great, at least, but history is vague or silent on these events. It is supposed by scientists that many years of the earth's surface now quiet were in ancient and primeval periods the scenes of terrific shocks.

No earlier earthquake remains recorded than that of 425 B. C., when the island of Euboea was formed. What loss of life there was then not even a legend relates. An earthquake accompanied the eruption of Vesuvius in 79 A. D. In 742 A. D. Syria, Palestine and other regions were devastated by a series of shocks which destroyed more than five thousand towns and hundreds of thousands of persons.

Sicily's earthquake in 1137 took fifteen thousand lives, and from that time history is replete with records of similar catastrophes. Earthquakes

have occurred with greater frequency in volcanic districts, and particularly along the boundaries between great elevations and depressions. But such shocks are not confined to volcanic areas, and, indeed, they have often occurred in regions remote from them. One large zone particularly liable to earthquakes encircles the earth. It includes the Mediterranean lands, the Azores, the West Indies, Central America, the Sandwich Islands, Japan, China, India, Persia and Asia Minor.

China's and Japan's losses have been enormous and earthquakes there have been of such frequency as to excite little comment. The Japanese scientists have been diligent students of these phenomena, and the number of their opportunities is evident from the fact that between 1885 and 1892, when the closest observations were made, there were 8,331 earthquake shocks. In 1703 200,000 Japanese lives were lost in the earthquake at Yeddo. Her latest great disaster of that kind was in 1891, when 10,000 persons perished in the Island of Hondo.

EARTHQUAKES IN THE FAR EAST.

China's sufferings from earthquakes have been almost equally appalling. In 1731 there was a loss of 100,000 lives in Pekin and vicinity. In 1830 Canton was shattered and 6,000 persons died. Lesser disasters have followed with great frequency till the death roll has become enormous.

In six minutes the city of Lisbon was laid in ruins in 1755, when 30,000 lives were lost. This great shock was felt over a wide area, even on the Baltic and in Great Britain. Silicia lost 60,000 persons in 1768; Naples, 40,000 in 1456, 70,000 in 1626 and 6,000 in 1805. Sicily had a terrible disaster in 1693, when 100,000 persons died. Kashen, Persia, was stricken in 1755 and 40,000 lives were lost. Panama lost 40,000 inhabitants in 1797; Aleppo, 20,000 in 1822; Ecuador and Peru, 25,000 in 1868. These are only the more costly disasters of the hundreds of earthquakes that have terrified and slain mankind. The Calabrian earthquake, beginning in 1783, continued for four years.

In comparison with these stunning cataclysms the losses in the United States have thus far been paltry. The first earthquake of which there is any record in this country was that in Inyo Valley, California. The most notable shock before that of yesterday was the one which on August 31,

1886, was felt from Florida to Canada and as far west as Iowa and Missouri.

New Hampshire and Vermont felt a slight shock on November 27, 1893. The Pacific Coast has experienced many tremors. Various other parts of the country have been agitated infrequently by slight agitations that have entailed no losses to life or property.

The well-known author, Bret Harte, who resided a number of years in California, had a presentiment of the impending fate of the Queen City, as shown by the following lines:

FATE.

"The sky is clouded, the rocks are bare;
The spray of the tempest is white in the air!
The winds are out with the waves at play,
And I shall not tempt the sea to-day."

"The trail is narrow, the wood is dim,
The panther clings to the arching limb;
And the lion's whelps are abroad at play,
And I shall not join in the chase to-day."

But the ship sailed safely over the sea,
And the hunters came from the chase in glee;
And the town that was builded upon a rock
Was swallowed up in the earthquake shock.

CHAPTER III.

WOMAN REFUGEE AND OTHER EYE-WITNESSES RELATE THEIR THRILLING EXPERIENCES.

THE Los Angeles *Examiner* printed a thrilling story from Helen Dare, of its staff, who escaped from the stricken city to Oakland and thence to Stockton, where she telegraphed the following account:

No one who has not seen such a disaster as this that has befallen San Francisco can have any realization of the horror of it, of the pitiful helplessness and inadequacy of human beings thus suddenly cast before the destroying forces of nature.

It was like a cataclysm. People cried out to each other like the coming of the end of the world. The oscillation was north and south in a succession of increasing and apparently renewed shocks, with a twisting movement that threw sleeping people out of their beds.

In two minutes the great city was ruined. Many were killed, perhaps hundreds, perhaps thousands, for in the scattering, followed by confusion and fire, no one can estimate the number of deaths. No part of the city escaped from wreck, fire and death. Gas, water and electric power were shut off.

Dynamite and gun cotton and even field guns are being used, blowing up whole blocks at a time. Thousands of people are sleeping out under the trees at Golden Gate Park.

Perhaps my own personal experience will tell the story. Like thousands of others, I was awakened out of peaceful sleep into a paralysis of fear by the violent and continued rocking of bed, of floor, of walls, of furniture, by the sounds of crashing chimneys, falling ornaments and pictures, breaking glass and the startled screams of women and children. As if with a sudden impact, I felt my bed struck from the north and then heave violently. I jumped out, putting my hands out to steady myself, but the opposite walls seemed to move away from me.

The floor rocked like a boat on a choppy sea, the violence of the motion

increased and seemed ever and again to take a fresh start. It seems as if it would never die—and yet it lasted but two minutes. My young son came running from his room, and, clasped in each other's arms, we stood in the doorway of my room waiting, waiting.

With a relaxing quiver—like the passing of a sigh, the heaving earth and billowing floor sank into repose. We dressed, and through the disarranged furniture, over the broken glass and fragments of ornaments, we made our way out.

The streets were full of persons in every stage of undress and excitement, one young mother in her night dress, clasping her eight-months-old baby in her arms and trying to warm it by wrapping her thin lawn garment around it.

A few blocks from Mayor Schmitz's home, and a block from Mrs. Eleanor Martin's, the house where I have been stopping, is in the western addition, where, owing to the hills of rock formation the damage was least.

CROWDS OF PERSONS CLIMBING THE HILLS.

The swarming persons climbed the hills, their first fear being that a tidal wave would follow, and all eyes were on the bay, shining in the morning light, but not even the sea wall of the land that the Fair Estate is reclaiming from the ocean, was hidden by water.

I set out at once to see what damage had been done, finding it more appalling with every block I walked. My way led along Pacific and Van Ness Avenues, through the district of splendid homes of wealth and fashion, and not one of the long line of imposing houses but had suffered severely.

The home of John D. Spreckels, at Pacific Avenue and La Guana Street, is one of the finest and proudest in the city and on it the parapet had cracked and crumbled and fallen like so much spun sugar out of a wedding cake. Blocks of cement had fallen from the entrance ceiling and at one of the upper windows a wan, white face peered from the rich lace curtains.

At Rudolph Spreckels' handsome house, at Gough and Pacific Avenue, the lawn was riven from end to end in great gashes, the ornamental Italian rail leading to the imposing entrance was a battered heap. Rudolph Spreckels, his wife, his little son, his mother-in-law and sister-in-law and maid servants had set up their household on the sidewalks.

The women were wrapped in rugs and coverlets and huddled in easy chairs hastily rolled out. They were having their morning tea on the sidewalk and the silver service was spread on the stone coping. At house after house of the wealthy and fashionable this scene was repeated.

Turning into Van Ness Avenue, there on the left was St. Bridget's stone church at Broadway and Van Ness, with its tall towers fallen and the stone walls hanging loosely from the top. There on my right, a couple of blocks away, was St. Luke's Church, a total wreck, its tower of stone just a heap of waste. The churches have suffered greatly.

St. Patrick's and St. Dominick's are wrecked and the old Mission Dolores of the Franciscan Fathers has the ancient tiles of its roof crushed in, though the adobe walls still stand, but the steeple of the new church beside it in toppling over crushed in its roof.

FLEE IN BARE FEET.

All along the two avenues of fashion, not a brick chimney was left standing. In every block there are tons and tons of wreckage. Claus Spreckels' home on Van Ness Avenue had its cornices and parapet crumbled like a pie crust. Walter Hobart's house, that was built for Amy Crocker when she became Mrs. Porter Ashe, has all one side wrecked.

The St. Dustan, at Sutter and Van Ness, one of the smartest apartment houses, built of stone, has its top story tumbled off and its solid walls cracked. At McNutt's Hospital, nearly opposite the St. Dunstan, on Sutter Street, the patients who could be moved had been brought to the door and sidewalk, and anxious inquirers were rushing up to get news of dear ones within who are bedridden or recently operated upon.

The new national bank on Polk Street, near Sutter Street, is a wreck with its plate glass windows in splinters on the pavements. All Sutter Street as I look ahead seems an avenue of ruin. The Granada, a big fashionable hotel, has its top and front shattered. Whole houses, I can see, are tumbled down.

I must pick my way among the middle of the streets between the heaps of ruins. I find the streets swarming with people, white, wide-eyed, still-awed, and others again exceedingly voluble in their terror, telling to every one their story of what has happened to himself.

Automobiles are tearing and honking madly in every direction, filled with frightened men and women and children, some dressed as though for a promenade, others partly dressed or wrapped in bed clothes. Never were stranger automobile parties than these.

I see one little woman carrying her baby, her tear-wet face clinging to its baby cheeks, and she wears only her night dress and a kimona, and her tender bare feet patter across the sidewalk from a mansion door to an automobile.

Here again is an old, old woman, with wrinkled face, paper-white, somebody's grandmother, she is—and she is being trundled along in an invalid chair, her family with hastily made bundles of clothes and valuables, all about her. Great clouds of smoke rise dull and dark on every side and red, angry flames shoot long tongues through them.

MIGHTY ROAR OF FLAME.

I hear the roar and crackling of fire unrestrained, and with every blow I feel the heat on my cheeks and the cinders and ashes sifting down upon me. When I come to Powell Street I see the St. Francis Hotel still standing and the cinders and brands pouring upon its roof. Remember, this is only 7 o'clock. In Union Square the grass is covered every inch of it with frightened, huddled people, who have sought the open.

Kearney Street and Montgomery Street are highways of confusion. The poor, south of Market Street, thus suddenly thrown out, are in exodus toward Telegraph Hill, dragging and trundling such household goods as they have managed to save.

Here are boys and a thin, flat-chested woman trundling a sewing machine along. A drawer of it falls out and they halt to gather up the precious scattered spools. Poor little seamstress, this is her all now.

Here is a wagon fitted with bedding and cooking utensils, a crying woman and a baby on the seat, a bird cage dangling at the tail and two men taking the part of horses. Then a crazy night hawk hack, a white-faced woman dragged from her sick bed in it, fainting in the arms of another woman.

Then a big road machine, screeching along, a red, fat-faced man standing up in it mopping his brow, his eyes searching for the building

that holds his business, and little street boys darting in and out, snatching what they can get, throwing that away and snatching more like children wantonly picking wild flowers.

I see one little creature capering with three hats on his head that he had taken from a show window. Before the banks and safe deposit vaults men and boys employed there are busy pulling out drawers full of ledgers and valuable papers, carrying them away in their hands, loading them into wagons and even into wash buckets.

SCENES IN HER FLIGHT.

On the step of one bank, with the fire only a block away, I see a man wringing his hands and crying aloud: "Will he never come. Will he never come with the combination? My God, why doesn't he come?"

I can't get to the Postal Telegraph office for the dead line of the police and the crowd. I find the Western Union wrecked with bewildering clerks repeating, "All wires down, all wires down!" to the pale-faced and dirty-faced men and women who want to send messages out reassuring their friends.

Every few seconds there is a booming sound that adds to the horror, the confusion and fearsomeness of the scene. It comes from the dynamite detonations where they are trying to check the spread of the fire by blowing up buildings. A theatrical man comes running along telling how the Grand Opera House has fallen in and is on fire with all Conreid's grand opera settings and the singers' beautiful things going up in smoke. He laughs idiotically, poor chap, and says: "Sudden close of the opera season, isn't it?" The Majestic Theatre is a ruin, too, with both walls fallen in.

The newspaper offices still stand, but this is only 7 o'clock, and with their power cut off and no way to get off the extras that would sell like hot cakes. I see before the door of every one my fellows gathered in silence, for once, and dazedly looking on. It is too awesome a scene even for the newspaper men.

I try to make my way to the ferry, first down one street and then down another, leading to the water front. Each one as I try, from Post to Washington, is closed by fire or wreckage, and there is no way through. On Washington Street, opposite the old post office, a building has completely collapsed, and under its edges are horses struggling and dying.

At last I find an open way on the next street, and with the warmth of the blaze of water front saloons on my back I hurry across the upheaved street and twisted car tracks. This is made ground and the earthquake played with it as a child plays with a cardboard, crushing, creasing and bending it. On the bay side of the water front the old docks have tumbled and look like so much kindling wood. The tower of the ferry building is destroyed and broken. The passengers stream aboard the ferryboat—the only boats running are the "Southern Pacific"—and turn to look back upon their city.

From this point there is something colossal in the disaster that has befallen. A great cloud is rising magnificent and overwhelming in its proportions—growing ever black and blackest toward the ground, spreading wider and wider. The red flames shoot skyward through it and but emphasize its density and violence.

PERILOUS TRIP TO STOCKTON.

The Fairmount's marble walls gleam orange through the flames. The *Call* building rises like a sentinel and far beyond you can make out through the murkiness black splotches upon the green, the people hurrying to the San Bruno hills. On the Pine Street hill I can see a row of old ramshackle cottages that have slipped from their foundations into the street, apparently intact.

On Telegraph Hill, on the highest place, the sky line is marked with a garb of upended fringe of the people who have sought refuge up there at the top of the streets. There are no trains moving other than the Oakland local when we get to Oakland, for there are no wires to send train despatches on. At last a train moves out to Stockton, taking its chance, and a few venture on it.

It is 10 o'clock and we have nothing to eat and drink, but we give no thought to that. I plan to make my way to San Jose and telegraph from there, but by 11 o'clock we know that San Jose is wiped out. A few wan, red-eyed refugees from San Jose are coming to San Francisco, and we meet them at Niles.

"San Jose is flat on the ground," "San Jose is gone"—these are the messages they bring. All brick buildings are down there.

The security of the rails was suspected and the train traveled cautiously. From East Oakland nothing was known of incoming trains or the conditions of the road.

Collisions were imminent and every curve was breathlessly rounded. Each bridge and trestle was a new danger, and when the train crept into the Altamount tunnel it seemed as if no one breathed in any of the dark cars and a sigh swept through when the daylight gleamed at the other end.

Coming from Oakland to Stockton the effects of the earthquake were apparent as far as Lathrope, lessening as we drew away from the Mole. Our train only crept along at times.

The personal narratives of other sufferers are no less thrilling than the foregoing. Albert H. Gould, of Chicago, was one of three persons to arrive in Los Angeles on the first train from San Francisco.

"I was asleep on the seventh floor of the Palace Hotel," he said, "at the time of the first quake. I was thrown out of bed and half way across the room. Immediately realizing the import of the occurrence and fearing that the building was about to collapse, I made my way down six flights of stairs and into the main corridor. I was the first guest to appear. Clerks and hotel employees were running about like mad men. Within two minutes after I had reached the corridor other guests began to flock into the court. Most all wore night clothing only. Men, women and children stood as though fixed. Children and women cried. The men were hardly less affected.

CITY DOOMED.

"I returned to my room and got my clothing; then walked to the offices of the Western Union, in my pajamas and bare feet, to telegraph to my wife in Los Angeles. I found the telegraphers on duty, but all the wires were down. I sat down on the sidewalk, picked the broken glass out of the soles of my feet and put on my clothes. All this, I suppose, took twenty minutes. Within that time, below the Palace Hotel, buildings for more than three blocks were a mass of flames, which quickly spread to other buildings. The scene was terrible.

"The Spreckels Building, at Third and Market Streets, looked out of plumb. I remained in San Francisco until 8 o'clock and then took a ferry

for Oakland, but returned to the burning city an hour and a half later. At that time the city seemed doomed. I remained a few minutes, then made my way back to the ferry station.

"People by the thousands were crowded around the ferry station. They clawed at the iron gates like so many maniacs. They sought to break the bars, and failing in that turned on each other. After a maddening delay we got aboard the boat and crossed the bay."

J. P. Anthony, a business man of Pacific Grove, arrived in Los Angeles, having made the trip from San Francisco by automobile. He left there at 6 o'clock in the evening. Mr. Anthony was the first eye witness to bring direct information from San Francisco. He said that he was sleeping in his room at the Ramona Hotel, on Ellis Street, near Mason. He was suddenly awakened at 5.23 in the morning. The first shock that brought him out of bed, he says, was appalling in its force. The whole earth seemed to heave and fall. The building where he was housed, which is six stories high, was lifted from its foundation and the roof caved in. A score or more of guests, men and women, immediately made their way to the street, which was soon filled with people. A panic ensued. Debris was showered into the street from the building on every side.

Mr. Anthony said he saw a score or more of people killed. Women became hysterical and prayed in the streets, while men sat on the curbing, appearing to be dazed. It was twenty minutes before those in the vicinity seemed able to realize the extent of the catastrophe. The crowds became larger and in the public squares of the city and in empty lots thousands of people gathered.

POLICE WARN PEOPLE FROM HOUSES.

It was 9 o'clock before the police were in control of the situation. When they finally resumed charge, the officers directed their energy toward warning the people in the streets away from danger, many buildings being on the point of toppling over.

Mr. Anthony said he was walking on Market Street, near the Emporium, about 9 A. M., when another severe shock was felt. At once the street filled again with excited persons and thousands were soon gathered in the vicinity, almost paralyzed with fear.

Before the spectators could realize what had happened the walls of the building swayed a distance of three feet. The thousands of bystanders stood spellbound expecting every moment that they would be crushed, but another tremor seemed to restore the big building to its natural position. Mr. Anthony said that he momentarily expected that with thousands of others who were in the neighborhood he would be crushed to death.

He made his way down Market Street as far as the *Call* building, from which flames were issuing at every window, with the blaze shooting out of the roof. A similar condition prevailed in the *Examiner* building across the street. He then started for the depot at Third and Townsend Streets, determined to leave the city. He found several thousand other persons headed in the same direction. All south of Market Street about that time was a crackling mass of flames.

CUT OFF BY THE FLAMES.

He made his way to Eighth and Market, thence down Eighth to Townsend and to Third Street and the entire section which he traversed was afire, making it impossible for him to reach his destination. He attempted to make his way back, but found that retreat had been cut off by the flames. He then went to Twelfth Street and reached Market Street again and walked down to the City Hall. San Francisco's magnificent municipal building had in the meantime caved in like an eggshell. The steel dome was still standing, but the rest of the $7,000,000 structure was a charred ruin.

It was not yet noon, but the city's hospitals were already filled with dead and injured and all available storerooms were being pressed into service. Dead bodies were being carried from the streets in garbage wagons. In every direction hysterical women were seen. Men walked through the streets, many of them weeping, and all with white, drawn faces.

Transfer men were being offered fabulous sums to remove household goods even for a block distant. Horses had been turned loose to prevent their being incinerated in the burning buildings and were running at large. Women had loaded their personal belongings on carts and were pulling them through the city, the property being piled in the public squares.

J. H. Ritter, of Houston, Texas, said:

"I was in the Golden West Hotel when the first shock came. When I awoke, the hotel was rocking like a cradle. While I was dressing, the rear wall of the hotel fell into the dining-room. I was dressed by the time the second shock came and was going to rush out of the building, but the appeals of the women on the same floor stopped me. With some of the other men guests on the fourth floor, we got the women out. Most of the women were hysterical.

"Many naked and half-dressed persons were in the streets, running about crying, screeching, wild with fear, while buildings toppled over and choked up the streets."

R. A. Cole, a horseman, was at the Palace Hotel, when the quake came. He said: "I never saw anything like it. I was in the St. Louis cyclone and the Baltimore fire. They were nothing. I saw all San Francisco staggering and rocking and then in flames."

Mrs. Agnes Sink said: "I was staying at 35 Fifth Street, San Francisco. The rear of the house collapsed and the landlady and about thirty roomers were killed. I escaped by the roof, as the stairway had collapsed in the rear. Out in the street it was impossible to find a clear pathway. I saw another lodging house near ours collapse; I think it was at 39 Fifth Street, and all the inmates were killed. In a few minutes the entire block was in flames."

EARTHQUAKE THEORIES.

That San Francisco was the centre of the earthquake area was a mere coincidence in the workings of nature, is the opinion of Amos P. Brown, professor of mineralogy and geology at the University of Pennsylvania. The theory advanced that a subterranean explosion took place under Mount Tacoma, in the State of Washington, is also given little credence by Professor Brown.

"At present no one knows anything definite," said he, "and the best authorities can do is to form opinions based on their knowledge of the earth's surface and upon the likelihood of eruptions to break forth from the known mere shallow crusts of the earth's surface.

"As has been said, the whole coast line of the Pacific ocean is more

or less subject to earthquakes and volcanic eruptions. In some places the earth's surface is constantly rising and in others it is sinking at the same time. This movement is very gradual to be sure, and it takes years and years for the movement of an inch ordinarily. Sometimes this movement is rapid and at every such occurrence there is an earthquake.

"A movement of a quarter of an inch in the solid sub-strata of rock will cause an earthquake. A movement of an inch will cause a tremendous earthquake which will shake down buildings of wood and stone even as happened at San Francisco. How large a movement there was along the Pacific Coast no one can now tell.

"As the surface rises in one place it lowers in another. The molten lava which composes the centre of the earth moves into the cavity caused by this rise and runs from the place of depression. The earth is a solid. Whenever the greatest pressure is brought to bear, then a sinking occurs, and conversely a rising is made where there is the least resistance. The Cascade Mountain range has been rising for years, and it is very probable that some sudden movement caused a crack which occurred directly under the San Francisco district.

FURTHER DISCOVERIES NECESSARY.

"The theory that so much was taken out of the earth by Mount Vesuvius at the late eruptions that a depression occurred at the other side of the world is possible. However, it is not probable. Science knows of no such facts as that, and to advance the theory as a fact would be impossible until some such actual discovery is made.

"The earth has a diameter of about eight thousand miles. Vesuvius hardly cast out enough lava and ashes to make a very great difference. The theory is easily answered by the instance of the eruption of Mount Pelee several years ago. The lava cast out there was much greater than at Vesuvius, and there was no subsequent earthquake.

"As no reports have come from Mount Tacoma, we can say nothing of an eruption there. I hardly think such a thing has occurred, yet it is surely possible. It seems that should there have been an eruption there the effect would have been more serious in that region than as far south as San Francisco. The best theory is that of the movement of the earth's surface.

"The whole western coast of America is subject to these movements North America gets numbers of them in slight earthquakes. Central America has more. They are of more frequent occurrence in South America. Chili is visited by them more than any other country in the world. Surely this eruption has been more serious than any in recent years."

William Easby, Jr., professor of civil engineering at the University of Pennsylvania, said that the fact that Leland Stanford, Jr., University was demolished shows in slight measure the force of the earthquake.

"This University was constructed with the special purpose of withstanding such shock," he said. "The buildings were all built low and of massive foundations. To overthrow them took tremendous force."

ORIGIN OF THE SAN FRANCISCO CALAMITY.

Dr. G. F. Becker, chief of the division of physical researches of the United States Geological Survey, who lived many years in California and made a special study of seismological disturbances for the government, is quoted as saying that the earthquake in California had no relation to the recent eruptions of Vesuvius. He ascribed the "shake" to an unusually acute development in the process of "faulting," which has been going on along the Pacific Coast for thousands of years. This process consists in a readjustment of the rocks forming the crust of the earth.

California is a chronic sufferer from earthquakes in mild form, he said, but the severity of the recent "shake" was due, in his opinion, to the fact that there had been a suspension of the shakes in recent years, and consequently the disturbance was due to an accumulation, or, in other words, a greater amount of earth was shifted, or "faulted," in this "shake" than has been the case before.

"Along the coast of California, at a relatively short distance from the shore," said Dr. Becker, "the shoal water suddenly becomes very deep, and from a depth of a few fathoms changes abruptly to a depth of perhaps thousands of fathoms. This great submarine cliff extends all the way to Chili, the same geological formation being noted generally. It may be described as a great line of uplift in the earth's surface extending all the way from Singapore around to Valparaiso.

"It is a line characterized by a deep adjoining abyss. That line is the great volcanic line and the great earthquake line of the world. It passes through the volcanic regions of Japan, through the Aleutian Islands, along the coast of Alaska and to Mount Shasta, which, though not an active volcano, is representative of the type, then extending to South America with characteristic volcanic developments.

"Now there have been changes in the elevation along the line of this fissure, due to changes in te elevation and canged conditions inside the earth, and it is owing to these changes or 'faults' that the ground is shaken in California while the earth's rocks are readjusting themselves.

"In my opinion, there can be no connection whatever between the San Francisco earthquake and the Vesuvius eruptions. The first and conclusive reason is that Vesuvius is not on the same fissure of the earth as California. Then, too, the shakes caused by Vesuvius could affect only a local area.

"I would like to add that I do not think there is any danger of a recurrence of a severe earthquake of this kind in California for a very long period of time. Of course, there may be mild shakes for some time, but the readjustment of the earth's crust, in this disturbance, was probably so complete that there will be no change in the geological formation for many years."

OPINIONS OF SCIENTIFIC EXPERTS.

These views of Dr. Becker were practically endorsed by Prof. Charles D. Walcott, director of the geological survey; C. W. Hayes, director of geology in the Geological Survey, and Prof. James F. Kemp, of Columbia University.

"The earth, take it as a whole," said Mr. Hayes, "is a very uneasy body, and is in a state of constantly changing equilibrium. When the foundations, deep down, change, there has to be an adjustment of the surface, like the break-up of ice on a river, and readjustment of the blocks to each other. Evidences of such changes are found all along the Pacific Coast. All through California it is quite evident that the earth's surface is continually adjusting itself to internal conditions."

"The Pacific Coast line is one of the latest additions to the continent."

said Professor Kemp, "and because of this is far more subject to seismic disturbances than any other portion of the country. Earthquakes are quite common, as is shown by the records quoted in the Geological Society's bulletins. According to these there were fifty-five such disturbances in California and elsewhere along the Pacific Coast in 1896, eighty in 1897 and twenty-four in 1898, but none were severe, except that of March 30, 1898.

"The outer crust of the earth adjusts itself from time to time," he said, "and this is most probably one of those instances. Scientists do not yet fully understand the exact nature of this adjustment, but there are two suggestions as to the probable cause which are generally accepted—first, that on account of the radiation of heat from the earth its interior is shrinking and earthquake is the natural way the surface adjusts itself to the new conditions; second, that the earth is gradually slowing up in its rotation, that it is flattening at the poles and swelling at the equator, and that this causes the interior disturbance."

SCIENTIFIC VIEWS OF EARTHQUAKES.

Professor Marvin, the observer in charge of the San Francisco weather station, when asked if the earthquake at San Francisco could be connected with disturbances in Vesuvius, said he did not think there was any common cause.

"The disturbances around Vesuvius were purely local," said he. "We had no record here of any vibrations in the earth's surface, and the general belief of scientists is that the phenomena there were wholly local. This earthquake at San Francisco is more general in character. It was undoubtedly recorded in India and in England. You can see how rapidly such earthquake waves travel when you note that the reports say the upheaval occurred in San Francisco at 5.13 or 5.15 and our first register of the vibrations began at 8.19. The first small waves of tremors travel much more rapidly than the larger waves, and the first record shows that these small waves came across the continent in from four to six minutes. If there was a tidal wave in consequence of the disturbance, it passed across the Pacific in a few hours, and was felt on the coast of Japan, probably. It must be remembered that we do not know the location of the cause of the

disturbance at San Francisco and cannot tell the direction of the greatest wave force.

"There have been more earthquakes in 1905 than for several years past," continued Professor Marvin. "We have had numerous records here of late. We cannot undertake to explain the causes of the earthquake at San Francisco. There may have occurred what the geologists call a fault, or the subsidence of a portion of the earth's surface."

CHAPTER IV.

PITIFUL SCENES WHERE ONCE STOOD A GREAT CITY.

THE wind, after having fanned the original conflagration in the district south of Market Street, turned when it had done its work there and swept the now irresistible fury of flame across Market Street, up the heights to the north, licked up the fashionable homes there as it had swallowed the hovels of Chinatown, and then turned again, spurring the hungry destruction toward the west and all that was left of the Queen City. Water was lacking and dynamite was giving out. Fire-fighters fainted, were carried away exhausted or injured.

It was resolved to make a last stand on the broad thoroughfare, Van Ness Avenue. A line of residences a mile and a half long was marked for sacrifice, in the hope that the flames might not be able to leap the space left by the ruins and the 100 feet of the street. But almost before execution of the plan was begun the fire was across the avenue and the final act of San Francisco's annihilation was entered upon.

But the plight of the living was little more happy than the fate of the dead. Thursday night 300,000 homeless people lay in the fields of the suburbs, on the beach, on the grass of Golden Gate Park, or where they could find a sheltered corner in the less crowded streets. Others fled by train, by road, by boat to nearby towns, 50,000 going to Oakland, across the bay. A slight earthquake shock in the morning stimulated a fresh panic.

Golden Gate Park was a great camp, over which tents and make-shift shelters were being raised. Families with a bed, cooking stove, a few chairs or whatever little furniture they were able to save, grouped miserably about all that remained of "home."

Mercifully the weather was mild. The University of California, at Berkeley, was providing on its campus for an army of refugees flocking thither.

The authorities were distributing food. Police and troops guarded groceries and bakeries, forbidding the sale of life's necessities otherwise than in small doles. Water was scarce, and grave fears were entertained

of the possibility of general and serious suffering from thirst. The bakeries and women of uninjured California towns were appealed to to bake and send loaves of bread to the stricken city.

The United States Sub-treasury was destroyed. The coin and currency in its vaults, however, were believed to be intact, and troops were on guard. The Mint escaped both the earthquake and the fire.

MAGNIFICENT HOMES GONE.

The magnificent residences on Nob Hill and Russian Hill were gone—among them the Stanford house with its art treasures; the Flood house, which cost $1,000,000; the Crocker residence, with its extensive stables. The Hopkins Art Institute was gone. The immense new Fairmount Hotel was burned. St. Francis's Hotel, a gigantic structure, also succumbed. What few office skyscrapers outlived Wednesday's terror were now ruins.

A Committee of Safety was formed to assist the Mayor. Order was preserved, though a few looters were shot, and horrible scenes were enacted among the ruins by dissolute revelers drunken on spoils taken from wrecked liquor houses.

In the towns surrounding San Francisco great loss of life and property was caused by the earthquake and fire which followed it. Santa Rosa was a total wreck; from 200 to 500 lives were lost and 10,000 people were homeless, while not a brick or stone building remained standing. What was left by the earthquake was destroyed by fire.

In San Jose ten persons were killed, and the Hall of Records and the Hall of Justice were destroyed. The Lick Observatory escaped injury.

In Alameda the loss of property is estimated at $200,000. No lives were lost, though a few persons were injured.

East Oakland, Los Banos, Martinez, Healdsburg, Geyersville, Cloverdale, Hopeland and Ukiah reported severe damage, with loss of life.

President Roosevelt, after a conference with officers of the American Red Cross, issued a proclamation calling upon the people of the entire nation to contribute to the relief funds. His appeal urged that all funds raised be placed in charge of the Red Cross, so that it would be expended to do the maximum good.

Congress took immediate steps to make the Government's relief plan

effective by appropriating $1,000,000 for the use of the War and other departments. The resolution freeing the money from the Treasury was passed first in the Senate, carrying $500,000. This was doubled in the House, and the larger amount was accepted by the upper house and immediately made available by the President's signature.

The Government's departments were busy all of Thursday forwarding food, tents, hospital supplies and other articles most needed in the work of relief. Secretary of War Taft issued orders for the sending of supplies from many points, and made every effort to have them arrive at the earliest possible time in the stricken city.

MANY MILLIONS OF DOLLARS READY.

The work of relief went on throughout the country and millions of dollars were raised for the sufferers. New York contributed three-quarters of a million dollars, and Chicago's two commercial bodies pledged $75,000, with the popular subscriptions to follow.

Councils of many other cities made appropriations and telegraphed the amounts to San Francisco, and plans for big benefit entertainments were made. Sympathy was expressed in cablegrams from all parts of the world, and the people of Great Britain were ready to give substantial aid.

Two relief trains from Philadelphia were speeding westward, laden with hundreds of army tents for the sufferers. They were sent from Schuylkill Arsenal on a rush order from the Quartermaster-General of the Army. More relief specials were to follow every day until the need was ended, the railroads carrying them free of charge.

The next day after the calamity, Thursday, April 19, dawned on a scene of death and destruction. During the night the flames had consumed many of the city's finest structures and skipped in a dozen directions to the residence portions. They had made their way over into the North Beach section, and, springing anew to the south, they reached out along the shipping section down the bay shore, over hills and across toward Third and Townsend Streets. Warehouses and manufacturers' concerns fell in their path. This completed the destruction of the entire district known as far south as Market Street.

After darkness thousands of the homeless were making their way with their blankets and scant provisions to Golden Gate Park and the beach to

find shelter. Those in the houses on the hills just north of the Hayes Valley wrecked section piled their belongings in the streets, and express wagons and automobiles were hauling the things away to the sparsely settled regions.

Hundreds of troops patrolled the streets and drove the crowds back, while hundreds more were set to work assisting the fire and police departments. The strictest orders were issued, and in true military spirit the soldiers obeyed. The curious were driven back at the breasts of the horses of the cavalrymen, and all the crowds were forced from the level district to the hilly section beyond to the north.

WATER SUPPLY CUT OFF

The water supply was entirely cut off, and maybe it was just as well, for the lines of fire department would have been absolutely useless at any stage. Early in the morning it was seen that the only possible chance left to check the flames lay in the use of dynamite. During the day a blast could be heard in any section at intervals of only a few minutes, and buildings not destroyed by fire were blown to atoms. But through the gaps made the flames jumped, and, although the failure of the heroic efforts of the police, firemen and soldiers was at times sickening, the work was continued with a desperation that will live as one of the features of the terrible disaster.

The magnitude of the calamity became apparent when the sun rose and dissipated the pall of darkness that hung over the city. Looking eastward from the heights in the central portion of the city, everything attested to the awful havoc wrought by earthquake and flame. Where once rose noble buildings, stood nothing but frail walls, tottering chimneys, heaps of twisted iron and huge piles of brick and mortar. Adding to the horror of the situation was the fact that the work of destruction had not reached its conclusion and that the flames were raging beyond control.

It was with grief and horror that the community viewed the ruin. The people were seemingly half dazed by the magnitude of the disaster. Possibility of famine presented itself with the coming of the day. At best the city never carried more than three days' supply of provisions and food, and with the wholesale districts and warehouses wiped out there was

already a shortage of food. Prices were in most instances more than trebled. An Associated Press man was obliged to pay 25 cents for a small glass of mineral water in the Hayes Valley district. Not a drop of water was to be had there except bottled mineral water.

REGULATING SALE OF FOOD.

Policemen were stationed at some of the retail shops, regulating the sale of foodstuffs and permitting only a small portion of goods to be delivered to each purchaser, the idea being to prevent a few persons from gathering in large quantities of supplies.

The military was unusually strict in observing the enforcement of the order to shoot all looters. One man on Market Street, who was digging in the ruins of a jewelry shop, was discovered by a naval reserve man and fired upon three times. He sought safety in flight, but the reserve man brought him down, running a bayonet through him.

The bodies of three thieves were found lying in the streets on the south side. Many reports of looters being killed by the troops were current. Concerted action of any kind, in fact, was out of the question, and almost every official was acting on his own responsibility, it being a physical impossibility to communicate with superior authorities.

On the day of the earthquake some sort of systematic communication could be had by means of automobiles, but the next day every street was piled high with ruins, and to add to this trouble there was constant danger from falling walls. On miles of streets the front walls of ruined buildings still stood, swaying with the concussions of distant dynamite explosions and the rising winds. Frequently a crash of stone and brick, followed by a cloud of dust, gave warning to pedestrians of the danger of travel.

All manner of reports of death and disaster came to the temporary headquarters of the authorities, but these reports were received guardedly, allowance being made for the likelihood of exaggeration, due to the confusion that prevailed.

The flight of residents from the city continued all day in the nature of a panic, the slight earthquake early in the morning accentuating their terrors. The ferryboats to adjacent counties were crowded to the utmost, and to the westward portion of the peninsula a constant throng of homeless

persons carrying their portable household belongings, added to the colonies in the secure sand hills and the parks. Golden Gate Park and the unimproved blocks of the district south and north of the park presented the appearance of tented cities, many varieties of shelter being improvised from bedding and blankets.

The wind changed to the west on Thursday and the flames changed their devouring direction southward, and began eating their wide swath from the water front, on the north of Market Street, up to what is known as Nob Hill, an eminence that had been selected years ago by the multi-millionaires of the "bonanza days" upon which to erect their mansions. This hill was surmounted by the Hotel Fairmount, just finished at a cost of over $1,000,000. The horror was universal when its destruction seemed inevitable, and when it finally took fire and routed the Public Safety Committee, who were directing the work of relief from that point. Steadily but surely the fire ate its way up the slope, consuming the homes of the late Mrs. Jane Stanford and the Hopkins Art Institute, built by Mark Hopkins, of Central Pacific fame.

NOB HILL'S COSTLY RESIDENCES.

The Stanford residence, which stood at the southwest corner of California and Powell Streets, at the brink of the hill, became the property of Leland Stanford, Jr., University upon the death of Mrs. Stanford. It contained many art treasures of great value. On the southeast corner of the same block stood the home of the late Mark Hopkins, who amassed many millions with Stanford, C. P. Huntington and Charles Crocker in the construction of the Central Pacific Railway. The Hopkins home was presented to the University of California by his heirs, and it was known as the Hopkins Art Institute.

One block west was the Flood home, a huge brownstone mansion, said to have cost more than $1,000,000. The Huntington home occupies the block on California Street just west of the Flood house. The Crocker residence, with its huge lawns and magnificent stables, was on the west of the Huntington home.

From the upward slope the fire also took a direction northwesterly into the district that had been left untouched. This portion of the town

embraced the Latin quarter, populated by persons of various nationalities, and the houses were all of flimsy construction.

In the Hayes Valley district, south of McAllister and north of Market, the fire was confined up to noon on the west by Octavia Street and on the north by McAllister Street. In these confines the destruction was complete. Therein were located St. Ignatius's school and church, of which only the sidewalks remained. Of the Mechanics' Pavilion, the scene of hundreds of great political, social and sporting events, not a timber remained. Opposite it was the St. Nicholas Hotel, and it is simply a pile of ruined bricks.

From this point down to the Oakland ferry an Associated Press man made his way through the menacing wall frontages, and climbing over hillocks of masonry and junk of all sorts in the middle of the city's greatest thoroughfare. The journey was heartrending, the scene appalling. On either side was ruin, nothing but ruin. To the south, in hundreds of blocks, hardly a building remained whole. In front of the post-office, on Seventh and Mission Streets, the ground had sunk for several feet.

Across an alley from the postoffice stood the Grant Building, one of the headquarters of the army. This was gutted. Opposite the Grant Building, on Market Street, the ruins of the Hibernian Savings Bank loomed up, its former beautiful frontage transformed into hideous aspect. This was the great bank if the middle and poorer classes, and its loss caused greater sorrow south of Market street than perhaps the loss of any one institution. From this point down to the ferry the same story could be told of each successive block.

WRECKS OF GREAT BUILDINGS.

At 11 o'clock Wednesday night the north side of the street had been untouched, and hope had been expressed that the great Flood, Crocker, Phelan and other buildings would be spared, but they are included in the list of destroyed property. The Palace Hotel still stood, a huge monument to the awful disaster, its blackened walls and empty interior bearing little resemblance to the huge hostelry of a day before.

The handsome and gigantic St. Francis Hotel, on Powell Street, fronting on Union Square, is a ruined shell. This was one of the high steel

structures that had defied the terrible trembler, but it became another sad tribute to the completeness of the devastation that visited San Francisco.

Among the other high sky-scrapers north of Market that fell prey to the flames were the fourteen-story Merchants' Exchange and the Mills Building, occupying almost an entire block.

Chinatown by noon Thursday was a furnace, and the denizens of that quarter earlier in the day had their simple possessions bundled for departure. On the farther western side the flames cut a wide path to Van Ness Avenue.

BODIES IN THE STREETS.

Thursday morning there were twenty-seven corpses lying in Portsmouth Square, gathered from various sections. It was said that elsewhere bodies were lying in the streets, there being no means available to remove them. In his travels down Market Street the Associated Press representative saw three bodies lying in the debris, some rude covering having been thrown over them.

The Committee of Safety, consisting of fifty prominent citizens, met with Mayor Schmitz and organized a Finance Committee, composed of James N. Phelan, F. W. Hellman, Claus Spreckels, J. Doweny Harvey, Thomas Magee, J. L. Flood, William Babcock, W. F. Herrin, M. H. De Young and Robert J. Tobin. Before the meeting had organized Claus Spreckels gave $25,000, Rudolph Spreckels $10,000, Harry Tevis $10,000, Gordon Blanding $10,000, Eleanor Martin $5000, J. L. Flood $5000, with a promise of more.

Committees were appointed to take charge of the relief of the destitute, and the work assumed some system.

Golden Gate Park was the main refuge, and supplies were sent there. Boats were provided to take people across the bay, and thousands were availing themselves of the privilege. The University of California, at Berkeley, volunteered to take care of 2000.

Mayor Schmitz appointed his Committee of Fifty Citizens special officers, with full power to represent him and with power to requisition men, supplies, vehicles and boats for public use.

Except for an occasional accident, no additional loss of life was

reported. People had time to leave the burning districts, though most of them lost all their belongings.

A number of persons perished in the flames. At Seventh and Howard Streets a great lodging house took fire after the first shock, before the guests had escaped. There were few exits, and nearly all the lodgers perished. One of the women in the building leaped, with her child in her arms, from the second floor to the pavement below and escaped unhurt. She said she was the only one who escaped from the house. Such horrors as this were repeated at many points.

One man was killed while trying to get a body from the ruins. Other rescuers heard the pitiful wail of a little child, but were unable to get near the point from which the cry issued. Soon the onrushing fire ended the cry and the men turned to other tasks.

At Mechanics' Pavilion scenes of heroism and later of panic were enacted. The great frame building was turned into a hospital with a corps of fifty physicians. Nurses volunteered, and the Red Cross ship from the Government yards at Mare Island contributed doctors and supplies. Late in the evening, while the ambulances and automobiles were unloading wounded at the building, the march of the conflagration up Market Street gave warning that the injured would have to be removed at once. Every available vehicle was pressed into service to get the stricken into hospitals and private houses of the western addition. A few minutes after the last of the wounded had been carried through the door fire shot from the roof and the structure burst into a whirlwind of flame.

COULD NOT BE WORSE.

The situation was summed up in a telegram sent Thursday morning by General Funston to the War Department at Washington. It read as follows:

"It could not be worse."

General Funston added that Lieutenant Charles C. Pulis, of Wisconsin, attached to the coast artillery, had been mortally wounded. Lieutenant Pulis was commanding a company engaged in blowing up a building at Sixth and Jesse Streets. A fuse proved slow, and when Pulis tried to relight it the charge was exploded.

General Funston earlier in the day had wired the War Department as follows:

"Your four dispatches received. Have already filed several for you. Impossible now to inform you as to full extent of disaster. City practically destroyed. Troops have been aiding police patrolling and maintaining order. Martial law has not been declared. Working in conjunction wtih civil authorities. Have not interfered with sending of any dispatches. You cannot send too many tents or rations. About 200,000 people homeless. Food very scarce. Provision houses all destroyed."

The following appeal for aid was sent out by Mayor Schmitz to Governor Pardee, and indicates the destitute condition of their people and their dire need of food and shelter:

"Send all supplies and tents possible to Golden Gate Park. Have bakeries in small towns bake all the bread they can. We want bedding, food and tents."

DECIDE TO BLOW UP RICH HOMES.

As the fire continued to spread in spite of the heroic work of the men who were dynamiting buildings, the Committee on Safety called a meeting at noon and decided to blow up all the residences on the east side of Van Ness Avenue, between Golden Gate Avenue and Pacific Avenue, a distance of one mile. Van Ness Avenue is one of the most fashionable streets of the city, and it is very wide.

Here the firemen, although exhausted from over twenty-four hours' work and lack of food, determined to make a desperate stand. They declared that should the fire cross Van Ness Avenue and the wind continue its earlier direction toward the west, the destruction of San Francisco would be virtually complete. West of Van Ness Avenue and north of McAllister constitute the finest part of the metropolis. Here are located all of the finer homes of the well-to-do and wealthier classes.

The military was notified of the decision to dynamite the handsome Van Ness Avenue homes, and barrels of gunpowder, the only remaining explosive in the city, were taken from the Presidio, Fort McDowell, Alcatraz and other nearby posts. Hundreds of police, regiments of soldiers and scores of volunteers were sent into the doomed district to warn the

people to flee. These heroically responded to the demand of law and went bravely on their way, trudging painfully over the pavements with the little they could get together. Every available wagon was taken by the military to carry the powder.

But even the heroic measures decided upon did not check the flames, and the fire leaped across Van Ness Avenue and rushed upon the handsome homes on the west side. General Funston sent this dispatch to Washington at 3.30 P. M. Thursday:

"Fire crossed Van Ness Avenue to the west at 3.30 P. M. Almost certain now that entire city will be destroyed. Have ordered troops from Monterey, and everything is going as well as could be expected."

SUB-TREASURY DESTROYED.

Later, as the flames continued to spread, General Funston wired to the War Department:

"Official report at police headquarters this date states that the Sub-treasury is entirely destroyed by fire, with the exception of the vaults, which contain all cash on hand. Suitable guards have been ordered to protect this money."

The fire marshal announced at 4 o'clock that more than two-thirds of the area of the city had been destroyed, and that there was no possibility of saving the rest. The following was the district north of Market Street devastated at that hour:

Sansome to Market Street, to Sacramento, to Buchanan, thence to California, to Hyde, to Eddy, to Larkin, to Gough and to Market. On the south side of Market Street the fire extended along Market Street to Fourteenth and below the Southrn Pacific tracks to the boundary.

The Southern Pacific Hospital, at Fourteenth and Mission Streets, was dynamited, among other buildings, the patients having been removed to places of safety. The Linda Vista and the Pleasanton, two large family hotels on Jones Street, in the better part of the city, were also among those blown up to stay the progress of the conflagration.

Thousands upon thousands of people had fled from the fire by the evening of the second day. They flocked to the ferries, to the parks, to the military reservation and to the suburbs. Residents of the hillsides in

the central portion of the city seemingly were safe from the roaring furnace that was consuming the business section. They watched the towering mounds of flames, and speculated as to the extent of the territory that was doomed. Suddenly there was whispered alarm up and down the long line of watchers, and they hurried away to drag clothing, cooking utensils and scant provisions through the streets. From Grant Avenue the procession moved westward. Men and women dragged trunks, packed huge bundles of blankets, boxes of provisions—everything. Wagons could not be hired except by paying the most extortionate rates.

PEOPLE TRAGICALLY CALM.

But there was no panic. The people were calm, stunned. They did not seem to realize the extent of the calamity. They heard that the city was being destroyed; they told each other in the most natural tone that their residences were destroyed by the flames, but there was no hysteria, no outcry, no criticism.

CHAPTER V.

THE DOOMED METROPOLIS A MASS OF SMOLDERING RUINS.

ONE of our well-known journals commented on the great disaster as follows:

"The tragedy that has smitten the people of San Francisco with dismay cannot be portrayed yet. It is too vast for the collection of details and the presentation of the awful picture complete. But for the suffering people, whose story is yet to be told, there is an immeasurable sympathy manifest as the best human instincts are aroused to action.

"Where but a few hours before was a city imperial in its beauty, proud of its history, hopeful of its future, alert, fearless and palpitant with ambition, is a field of smoking waste, whose glowing edge creeps outward. Buildings that rose grandly, wrought in steel and costly stone, lie humbled into dust and ashes. Fair mansions, riven and leveled, have vanished. The former home of industry smoulders. Great factories and marts, their clamor stilled, have gone down in ruin. In the vaults of the bank the gold and silver are fused and buried. Where the temple reared to the worship of God sent its spire aloft or the school so lately stood are twin piles of desolation.

"Sad as is the spectacle of material destruction, the mind turns rather to the people themselves. They are hungry and cold. Above them the roof is the murky sky, lit by the pyres of a city's hopes and labors. The supplies upon which they depended have been cut off. They suffer for food, water, clothing, light, shelter. No thought now for the comforts and luxuries of their lost homes. What shall they do? Whither shall they flee? Nearby towns that gladly would help are themselves aghast in the presence of death and disaster; the residents fled to the hills to pray under the stars, while in the distance they see the crumbled houses they dare not visit and the familiar streets their feet dare not tread.

"The heart of humanity is touched at the knowledge that the helpless

cry for aid, and response is quick and warm. These fugitives and homeless are our friends. We have broken bread with them. We have rested within their gates, finding there a gracious hospitality. They are of our blood and kin. The obligation to respond to the need is stronger than any written law, stronger than the decree spoken by a king. It is the obligation that springs from a feeling more love than pity. It does not furnish the impulse with which one hands dole to a beggar, but the impulse which causes him eagerly to share with a brother and think no gratitude due.

"Californians would be first to answer a call from the unfortunate. Now that they have been sore distressed, the all-pervading duty is to answer the call that comes from them. It is not the outcry of those who make demand. It is the silent call from people in the shadow of a great sorrow, contemplating the wreck of their desires, searching for their dead, looking with foreboding to the morrow.

NOBLE RESPONSE FROM OTHER CITIES.

"Let us do all that is possible to rob that morrow of some of its darkness by tribute rich and bountiful and freely bestowed. The great cities of the land nobly have started the work. New York, Philadelphia, Boston and other commercial centers are sending money and provisions, and will send. There is no limit to what they will do. No bound has been set to their contribution. Congress has made a large appropriation.

"In faith and hope the world will disagree,
But all mankind's concern is charity.

"The occasion demands charity; from the basket and store of plenty, willing tithes, heaped and running over. Messages of sympathy from all the land are followed by the visible tokens of sincerity. Rivalry in giving is a fraternal contest, and none need fear going to an extreme. The individual of moderate means has an opportunity to aid, while the offering of philanthropists, ever looking for worthy objects, should reach unprecedented figures.

"Mortal can hardly discern in the San Francisco calamity aught that faith could construe into a blessing, yet out of it the people of San

Francisco and its environs will learn that friendship leaps a continent to help, when help is needed, and that no community in the land is so remote that it may bear alone its burden of grief, or, unpropped, bend beneath the harshest blow of adversity.

"The ability of American cities to recover from grievous calamities is well illustrated in the case of Baltimore. Notwithstanding the great fire which devastated the city in February, 1904, the police census just completed shows that the municipality has made a very creditable gain in population. The last census taken by the police was in September, 1901, when the population was given at 517,035. The census just taken fixes it at 543,034. The city has made remarkable progress in rehabilitation in every way since the disaster. The restoration of Baltimore is a typical instance of the tremendous pluck and energy and the hopefulness with which American cities rise from colossal misfortune.

BIRTH OF A NEW METROPOLIS.

"The same causes which account for the existence of a great city in a certain location continue to assert themselves whatever befalls, and another, greater and fairer municipality appears upon the ruins of the old. Galveston, precariously situated, met its fate in September, 1900, when 6000 lives were lost and 7000 buildings, of the estimated value of $18,000,000, were destroyed, an appalling catastrophe for a city of that size, or of any size. A new city was immediately begun. The great seawall, intended to prevent a recurrence of the disaster, and the bustling and prosperous community which constitutes the new Galveston, are splendid monuments to American spirit in confronting a discouraging situation.

"Doctor Johnson said that the conflagration of a city, with all its tumult of concomitant distress, is one of the most dreadful spectacles which the world can offer to human eyes. Such a scene was witnessed in Chicago in 1871, when 100,000 people were made homeless and property of the value of $200,000,000 was destroyed. A year later Boston passed through a similar direful experience. Both cities swiftly recovered from the awful destruction, and to-day the 'burnt district' is only distinguishable from those which escaped the fire by its superior modern architecture.

"Nearly $300,000,000 of property was wiped out in these two cities

within thirteen months. How wonderfully the municipalities immediately affected survived the shock is a matter of history. At the moment the situation in San Francisco is exceedingly depressing, but not hopeless. The same energy and courage and faith that rebuilt other stricken American cities will, it is confidently believed, restore San Francisco in due season."

From further accounts of the terrible disaster, we learn that the Presidio Reservation, the vast Richmond district of thousands of acres. Golden Gate Park and the surrounding hills resembled one vast camping ground. Tents and improvised covering were erected everywhere, fireplaces built in the streets, beds and mattresses thrown down all over the section. The people thus situated were philosophical.

There was, of course, ever present the danger that the food supply would run out. Every grocery in San Francisco was taken by the authorities and each family was being sold only one article at a time. In many places the police and military prohibited overcharging. General Funston announced Thursday morning that rations would soon reach the city, and then the people would be supplied from the Presidio. Bakeries had already been built within the reservation, and the bread supply therefore had not failed completely.

THE MAYOR'S PROCLAMATION.

Mayor Schmitz issued the following proclamation Thursday afternoon:

"The Federal troops, the members of the regular police force and special police officers have been authorized to kill any and all persons engaged in looting or in the commission of any other crime.

"I have directed all the gas and electric lighting companies not to turn on gas or electricity until I order them to do so. You may, therefore, expect the city to remain in darkness for an indefinite time.

"I request all citizens to remain at home from darkness until daylight every night until order is restored.

"I warn all citizens of the danger of fire from damaged or destroyed chimneys, broken or leaking gas pipes or fixtures or any like causes."

From the water front the burned city could be seen in all its smoky nakedness. From the Pacific Mail dock to Vallejo Street, on the west

side, a distance of two miles, wreckage and ruin was the rule. The filled-in land facing the ferry building was a succession of little valleys, some four, others six feet deep. The ferry tower itself was out of plumb, and the big building was much twisted by the earthquake. Looking up Market Street from the ferry building, the city was a smouldering mass of ruins.

The day was bright and warm. The sun beat down on the tired workers and rescuers. There was scarcely any water to relieve the thirst of the suffering. The authorities were doing all in their power to remove the bodies of the dead, in order that a pestilence might be prevented. It had been necessary repeatedly to move the injured from places where they had sought refuge, for the fire spread with alarming rapidity. Water was the incessant cry of the firemen and the people; one wanted it to fight, the others to drink, but there was only a scant drinking supply.

Reports from the interior were most alarming. Santa Rosa, one of the prettiest cities of the State, in the prosperous county of Sonoma, was a total wreck. There were 10,000 homeless men, women and children huddled together. The loss of life was not to be estimated.

As the last great seismic tremor spent its force in the earth, the whole business portion tumbled into ruins. The main street was piled many feet deep with the fallen buildings. Not one business building was left intact.

This destruction included all of the county buildings. The four-story court house, with its high dome, was merely a pile of broken masonry.

FLED TO FIELDS AND HILLS.

What was not destroyed by the earthquake had been swept by fire. Until the flames started there was hope of saving the residence district. It was soon apparent that any such idea must be abandoned. This was appreciated by the citizens, and they prepared to desert their homes. Not even their household goods were taken. They made for the fields and hills, to watch the destruction of one of the most beautiful cities of the West.

A resident of Santa Rosa wrote:

"There is not a brick or a stone building left standing in Santa Rosa, and the devastated territory has been burned over. Dead bodies were being taken from the debris of wrecked houses on all sides. It is estimated that the death roll will foot up from 200 to 500."

Messengers brought the saddest tidings of the destruction of Healdsburg, Geyserville, Cloverdale, Hopland and Ukiah. This report took in the country as far north as Mendocino and Lake Counties and as far west as the Pacific Ocean. These are frontier counties, and have not as large towns as farther south. In every case the loss of life and property was as shocking as in San Francisco.

In East Oakland there was much damage. The Franklin School, in course of construction, was cracked and will have to be rebuilt. The damage was $50,000. The Rose Brick Company's works were wrecked. The 95-foot brick smokestack tumbled to the earth with a roar.

Railroads were inactive and all wires were out of commission. Railroad tracks across the marsh were twisted. The tall chimney at the old oil works fell across the South Side tracks at West Alameda.

HUNGER AND THIRST ADDS TO SUFFERING.

San Francisco was the city desolate. It seemed that the acme of its misery was reached when, at dusk of Thursday evening, flames burst from all sides of the beautiful Hotel Fairmount, the structure that, above every other, was apparently most strongly entrenched against the attack of the all-consuming fire. And surrounding that lofty pinnacle of flame, as far as the eyes could see to the south, to the east and far out to the west, lay in cruel fantastic heaps, charred and smoking, all that remained of the prosperous city. The metropolis of the Pacific Coast was in ashes.

It was another day of an uneven struggle of man against unconquerable elements. Acre after acre was ground into dust and ashes, despite the heroic perseverance of the firemen to limit the conflagration. At night there was a hope that the worst had been nearly reached and that, when morning dawned, the end would have come; but the hope was faint.

San Francisco was not disconcerted. Its best and highest class began at once to plan for restoration and to care for the stricken ones, and the relief was immediate and effective. Total subscriptions of $180,000 were announced at night. Arrangements were made for the immediate relief of the needy. The baking of 50,000 loaves of bread daily began. Free transportation was provided by the Southern Pacific Railway to destitute persons desiring to go to interior points.

All efforts to check the spread of the flames at Van Ness Avenue by blowing up a mile of buildings on the east side of Van Ness Avenue proved fruitless. The fire spread across the broad thoroughfare, and the entire western addition, which contained the homes of San Francisco's wealthier class, was now doomed. The destruction of the western addition of the city completed the work of the ravaging flames and marked the devastation of the entire city.

MAD FLIGHT TO SAFETY.

While the heroic fire-fighters were making the last stand at Van Ness Avenue, panic reigned among the survivors in other parts of the city. The intense heat and the absence of water had been so terrible that scores became frantic and others dropped from exhaustion in the streets. The streets were still choked with refugees hurrying hither and thither, scrambling wildly for an avenue of escape.

When the great rush of flames doomed the hotel and apartment house district along Ellis, O'Farrell and Suter Streets, early Thursday morning, men, women and children were rushing or staggering under heavy loads of luggage, some to the ferries at the water front in the hope of getting to Oakland and the east side of the bay, others to the hills, Golden Gate Park, the ocean beach, the Presidio and San Mateo Bay.

The trip to the hills and to the water front was one of terrible hardship. Famishing women and children and exhausted men were compelled to walk seven miles around the north shore in order to avoid the flames and reach the ferries. Many dropped to the street under the weight of their loads, and willing fathers and husbands, their strength almost gone, strove to pick up and urge them forward again.

In the panic many mad things were being done. Even soldiers were obliged in many instances to prevent men and women, made insane from the misfortune that engulfed them, from rushing into doomed buildings in the hope of saving valuables from the ruins. In nearly every instance such action resulted in death to those who tried it. At Larkin and Suter Streets two men and a woman broke from the police and rushed into a burning apartment house, never to reappear.

Probably 200,000 refugees were struggling to get out of the burning

city, and hourly the task was becoming more difficult, as the fire and heat cut off avenue after avenue of escape. The streets were filled with struggling people, some crying and weeping and calling for missing loved ones. Crowding all sidewalks in the threatened area were hundreds upon hundreds of householders attempting to drag some of their effects to places of safety. In some instances men with ropes were dragging trunks tandem style, others having sewing machines strapped to the trunks. Again, women were rushing for the hills, carrying on their arms only the family cat or bird cage.

There was no aid for anyone from outside sources. In the awful scramble for safety the half-crazed survivors disregarded everything but the thought of themselves and their property. In every excavation and hole throughout the north beach householders were burying household effects, throwing them into ditches and covering the holes. Attempts were made to mark the graves of the property so that it could be recovered after the flames were appeased. Sufferers were invading the few buildings that remained in the hope of finding something to eat. They only desisted when warned or shot by the soldiers.

At the ferry building a crowd of a thousand people were gathered begging for food and transportation across the bay. Hundreds had not even ten cents car fare to Oakland. Most of the refugees at this point were Chinamen and Italians, who fled from their burned tenements with little or no personal property.

SUFFERING HUNGER'S PANGS.

The suffering of many from hunger was pitiful. A mob of a hundred or more robbed a bread wagon and took the contents. The police made an attempt to interfere, but were powerless. Bread was arriving from Berkeley and Oakland and was being distributed in the north end of town by the relief parties organized by Mayor Schmitz.

Thousands of people slept in the hills at night or stood gazing with grim faces on the lurid scenes below. Women and children and little babies in arms were huddled together with the injured. In Golden Gate Park the people were camping, with gnawing hunger the companion of all. The wails of the injured and the calls of frantic survivors for friends and

relatives who were missing were pitiful. These crowds were constantly increasing, and the relief committees were doing all in their power to get bedding and food for the homeless.

Expressmen were charging from ten to fifty dollars to haul a load of baggage or give any aid to refugees. Liquor stores in the north end were broken into by thieves, and hundreds of men were carrying away bottled liquors when soldiers arrived. The men had to be clubbed by the military before they would drop the bottles. Soldiers smashed the bottles on the stones and drove the mob at the point of the bayonet.

When the mansions on Nob Hill, the Fairmount Hotel and Mark Hopkins Institute were approached by the flames, many attempts were made to remove some of the priceless works of art from the buildings. A crowd of soldiers was sent to the Flood and Huntington mansions and the Hopkins Institute to rescue the paintings. From the Huntington home and the Flood mansion canvases were cut from the framework with knives. The collections in the three buildings were valued in the hundreds of thousands. Few were saved from the ravages of the fire.

Five hundred cadets of the University of California entered the city to aid in the enforcement of martial law. The young collegians had orders to shoot without warning those caught looting. In many parts of the town where the crowds of survivors were the wildest, it was almost impossible to get around save at the point of a pistol. The soldiers were disarming every person seen with a weapon.

A MULTITUDE CRAZED BY THIRST.

The only institution on Market Street able to do business was, according to a reliable business man, the Market Street Bank, at Seventh and Market Streets. Although the upper part of this building and every building near it was wiped out, the space occupied by the bank was undamaged. A sign posted in the window stated that the bank would be open for business as soon as it was considered safe.

The greatest suffering among the thousands of homeless people was from thirst. Although the earthquake shocks had broken water mains in probably hundreds of places, strange to say, no water, or very little, at least, appeared on the surface of the ground.

At Powell and Market Streets a small stream of water spurted up through the cobblestones and formed a muddy pool. At this pool hundreds of people knelt and drank, women as well as men. In many places men took as many bottles of liquor as they could carry out of the groceries, but few of them succeeded in getting away with them. Wherever the soldiers saw a man with a bottle of liquor they forced him to give it up at the point of the bayonet, and immediately smashed the bottle on the ground.

The work of the regular soldiers in suppressing disorder is worthy of the greatest praise. Everywhere they showed the highest degree of courage. They did not hesitate to shoot whenever they found anyone looting, and probably twenty victims fell before them during Thursday.

HEROIC WORKING FIREMEN.

While firemen were blowing up a cable power house at Suter and Polk Streets and the McNutt Hospital and the St. Dunston apartments, nearby, in a vain effort to check the flames, the steeple of St. Mary's Cathedral, a Catholic edifice, which had withstood the earthquake shock, caught fire. A fireman with a hose tied to his belt scaled the high steeple and played a stream on the flames and the blaze was extinguished. Thousands of people cheered the heroic deed and the handsome building was saved.

When the fire on the easterly slope of Nob Hill was eating its way toward Telegraph Hill, the firemen finally managed to get a stream of salt water from the bay, pumped through a hose one mile long. This delayed the progress of the conflagration.

The reply of a grizzled fire engineer, standing at the corner of O'Farrel Street and Van Ness Avenue, beside a blackened engine, may not have been as terse as Hugo's guard at Waterloo, but the pathos of it could have been no greater. In answer to the question of what he proposed to do, he said:

"We are waiting for it to come. When it gets here we will make one more stand. If it crosses Van Ness Avenue the city is gone."

This avenue is ninety feet wide, and the possibilities of checking the march of the flames there looked hopeful. Orders were given to concentrate every fire engine in the city at this avenue, to marshal soldiers, police and

all workers, and make one last stand to save the remainder of the city. Huge cannons were drawn to the avenue to aid the dynamiters in blowing up the mansions of the millionaires on the east side of Van Ness Avenue.

Every available pound of dynamite was hauled to this point, and the sight was one of stupendous and appalling havoc, as the cannons were trained on the palaces and the shot tore into the walls and toppled the buildings in crushing ruins. At other points dynamite was used, and house after house, the dwellings of millionaires, were lifted into the air by the power of the bellowing blast and dropped to the earth a mass of dust and debris. The work was dangerous, and many of the men, who kept working for forty-eight hours without sleep and scarcely any food, may have been killed while making this last desperate stand.

FLIGHT FROM ST. FRANCIS HOTEL.

By the burning of the St. Francis Hotel, which was consumed, $4,000,000 went up in smoke. This magnificent caravansery, which at the time of its destruction was being enlarged at enormous expense, was filled with guests. The opera singers at this hotel, as well as those at the Palace Hotel, lost their all, with the exception of several violins valued at $12,000, which were saved from the flames at the eleventh hour by Nathan Franko, the musical director of the company. Costumes, scenery, personal belongings and musical instruments, everything, succumbed to the flames.

CHAPTER VI.

HEROISM OF BRAVE MEN FIGHTING FOR LIFE.

THE following graphic account of the awful horror, written by an eye-witness, will have a mournful interest to all readers. It describes the scene the next day after the disaster, and we reproduce it just as it was written, at Oakland:

San Francisco is apparently gone. To the west, across the bay, there is nothing but a great cloud of smoke, shot with streams of fire, and shaken now and then with the dynamite explosions by which they are trying vainly to check it. The fire is now everywhere.

Every refugee who makes his way to us through the smoke cloud brings news of a new region burning and gone. As nearly as we can learn, it has run all the way down the Mission Valley, taking the little houses of the working people, leaped up the California street hill, taking Chinatown in its path, and swept away the mansions which have crowned the city, and is breaking out sporadically in the western addition, where live the prosperous people.

So it has spared nothing, for the business district is already gone, and the fire is reaching further and further every hour into the tenement district to the South. It has taken all the thickly crowded parts of the tenement district and is reaching toward the thinly scattered parts on the Potrero. How much will be left when the fires finally burn down and go out we cannot dare to guess. If there is anything left, it will be the hills of the western addition. It is hard to see how anything else, absolutely anything, can escape.

Without sleep, many of us without food, we watched all night, all day, looking off toward that veil of fire and smoke which hides from us the city which has become a hell. Back of the sheet of fire and retreating backward every hour must be most of the people of the city, forced toward the Pacific by the gradual advance of the flames.

Thank heaven for the open space of the Presidio and for Golden

Gate Park! The great park runs on its western extent past a thinly populated district. The flames cannot leap across that; it will shelter the inhabitants on their last stand. The Presidio, wide-spreading and with only a few houses, is also safe, provided that the forests which form part of its area do not catch fire. There is at least an escape; but half the people whom the fires have cut off from the water front and an escape from the peninsula are homeless.

This afternoon a launch ventured out from Oakland water front and made the run as far as the Gate. The bay is overhung with smoke, but a change of the wind blew a rift as they passed the western addition, which stands on the hills skirting the bay. Through this rift the passengers could see sporadic fires in a dozen places and the little black forms of men fighting the flames without water.

O for a rain! The time of heavy rains is over; but often at this season of the year there comes a gentle and soaking spring rain. We cannot see the heavens for the smoke; but the feel of the air is dry, and even that mercy seems to be denied.

At intervals news comes to us from the refugees of what is doing behind the smoke cloud. It appears that the area of the flames spread all night. People who had decided that their houses were outside of the danger area, and had decided to pass the night, even after the terrible experience of the shake-up, under their roofs, hourly gave it up and struggled to the parks. There they lay in blankets, their choicest valuables by their sides, and the soldiers kept watch and order.

BUCKET BRIGADE FOR THIRSTY.

There is no water in the mains, and the chief suffering was from thirst. The soldiers, disregarding the order not to let people move about, permitted bucket brigades to go forth and bring back water to relieve the women and the crying children. To reach the water it was necessary sometimes to go a mile to one of the four reservoirs which top the hills.

I talked to one man who slept in Alta Plaza. The fire was going on in the district south of them, and at intervals all night exhausted fire-fighters made their way to the plaza and dropped, with the breath out of them, among the huddled people and the bundles of household goods. The

soldiers, who are administering affairs with all the justice of judges and all the devotion of heroes, kept three or four buckets of water, even from the women, for these men, who kept coming all the night long. There was a little food, also kept by the soldiers for these emergencies, and the sergeant had in his charge one precious bottle of whisky, from which he doled out drinks to those who were utterly exhausted.

Over in a corner of the plaza a band of men and women were praying, and one fanatic, driven crazy by horror, was crying out at the top of his voice: "The Lord sent it, the Lord!"

His hysterical crying got in the nerves of the soldiers and bade fair to start a panic among the women and children, so the sergeant went over and stopped it by force. All night they huddled together in this hell, with the fire making it bright as day on all sides; and in the morning the soldiers, using their sense again, commandeered a supply of bread from a bakery, sent out another water squad, and fed the refugees with a semblance of breakfast.

There was one woman in the crowd who had been separated from her husband in a rush of the smoke and did not know whether he was living. The women attended to her all night and in the morning the soldiers passed her through the lines in her search. A few Chinese made their way into the crowd. They were trembling, pitifully scared and willing to stop wherever the soldiers placed them. This is only a glimpse of the horrible night in the parks and open places.

RICH CARE FOR SHELTERLESS.

We learn here that many of the well-to-do people in the upper residence district have gathered in the strangers from the highways and byways and given them shelter and comfort for the night in their living rooms. Shelter seems to have come more easily than food. Not an ounce of supplies, of course, has come in for two days, and most of the permanent stores are in the hands of the soldiers, who dole them out to all comers alike. But the hungry cannot always find the military stores, and the news has not gotten about, since there are no newspapers and no regular means of communication.

An Italian tells me that he was taken in by a family living in a three-

story house in the fashionable Pacific Avenue. There were twenty refugees who passed the night in the drawing room of that house, whose mistress took down hangings to make them comfortable. In the morning all the food that was left over in that home of wealth was enough flour and baking powder to shake together a breakfast for the refugees. They were hardly ready to leave that house when the fire came their way, and the people of the house, together with the refugees, who included two Chinese, made their way to the open ground of the Presidio. With them streamed a procession of folks carrying valuables in bundles.

There came out, too, tales of both heroism and crime. The firemen had been at it for thirty-six hours under such conditions as firemen never before faced, and they do little more than give directions, while the volunteers, thousands of young Western men who have remained to see it through, do the work. The troops have all that they can do to handle the crowds in the streets and prevent panics. The work of dynamiting, tearing down and rescuing is in the hands of the volunteers.

A YOUNG MAN'S HEROISM.

This morning an eddy of flame from the edge of the burning wholesale district ran up the slope of Russian Hill, the highest eminence in the city. All along the edge of that hill and up the slopes are little frame houses which hold Italians and Mexicans. A corps of volunteeer aides ran along the edge of the fire, warning people out of the houses. But the flames ran too fast and three women were caught in the upper story of an old frame house. A young man tore a rail from a fence, managed to climb it, and reached the window. He bundled one woman out and slid her down the rail; then the roof caught fire. He seized another woman and managed to drop her on the rail, down which she slid without hurting herself a great deal. But the roof fell while he was struggling with another woman and they fell together into the flames. There must have been hundreds of such heroisms and dozens of such catastrophes.

We are so drunken and dulled by horror that we take such stories calmly now. We are saturated.

There is a darker side, too. At least four men have been shot for looting. There are no wharf rats in the world worse than those which infest

the San Francisco water front. Terror and the presence of troops kept most of these people penned up in the Portsmouth Square with the Chinese on the first day. Then a policeman shot one of them, and this had a good effect. But to-day they broke loose, and, joining with the rescuers, began to go through the buildings.

In the early afternoon one of these cattle came staggering out of a wine house on Green Street, his arms filled with champagne bottles, and already half drunk with brandy which he had found in the wreck. A soldier of the Thirteenth caught and held him. The orders of the troops are discretionary. The soldiers in charge stood him against the burning building and shot him before he knew what they were going to do. Three others were shot in the back on the run as they tried to get away with their plunder. There must have been a great deal more of this.

FATE OF SPLENDID BUILDINGS.

What can one say in detail of the disaster, except that the whole town not already burned must go? The business district, including all of the big structures which escaped the fire of the first day, is gone. To-day, the flames have taken the Merchants' Exchange building, brand new, and ten stories high, and Mechanics' Pavilion, which, after housing prize fights, conventions and great balls, found its last use as an emergency hospital. When it was seen that it could not last every vehicle in sight was impressed by the troops, and the wounded, some of them frightfully mangled, were taken to the Presidio, where they will be out of danger and find comfort in tents. The physicians are working on, without sleep and almost without food. There is food, however, for the injured—the soldiers have seen to that. Even the soldiers are flagging and are keeping guard in relays, while the relieved men sleep on the ground where they have dropped.

Early in the day the fire struck Union Square, the prettiest park in the city, where stands the St. Francis Hotel. On the way it burned up the house of the Bohemian, Pacific Union and Family clubs and the big retail shops along Post Street. The separate fire in the residence district took St. Luke's, the biggest Episcopal church. There is no word of the fate of the First Presbyterian, which stands only a block away, but this must have gone with St. Luke's.

When day broke the fire was running into the Mission district. This is a low country wihch runs from the terminus of Market Street to the suburbs. In a general way it is the habitation of the aristocracy of the working class, although it is sprinkled with old-time residences, notably the house of James D. Phelan, a former Mayor of San Francisco. This went, too. Everything that is attacked goes. The dynamite only checks it. Nothing but rain can save the city now.

SEEN FROM THE OCEAN.

The Cliff House, which stood on a precipice over the ocean facing the rocks where the seals barked all the year round, was not much damaged. This news was confirmed to-day by the captain of a little schooner which shot the Gate without a tow and managed miraculously to make dockage in Oakland. Far out at sea he saw the city as a puff of smoke which became a blinding haze as he crawled nearer to land. He reports vessels standing off the heads, afraid to venture in because of the smoke and the lack of tows. All day vessels in the harbor, fearing that the fire might reach them in some way, pulled out through the Gate. There are rumors that some of them collided and sank.

Along the wharves the fire tugs, of whose work little has been heard, have saved most of the docks. But now the Pacific Mail dock has been reached and is out of control, and finally China Basin, which was filled in for a freight yard at the expense of $1,000,000, has sunk into the bay and the water is over the tracks. This is one of the greatest single losses in the whole disaster.

There is no use in going any further with the detailed news of the damage. Except the better residence district, which has not gone yet, but is going fast, and the outlying suburbs, you may include everything else in the list—all gone, skyscrapers, business blocks, hotels, churches, public institutions, even hospitals. The Southern Pacific Hospital in the Mission went yesterday morning. It is reported that a set of improvised ambulances got the patients away safe, although no one knows here where they were taken. The regular City Hospital, so far out of town that it must be spared, is crowded, even to mattresses on the floors. Many bodies were left in the ruin of the Valencia Hotel, 17th and Valencia Streets, and

they will now be consumed in the flames. In fact, this must happen all over the city.

Anyone who knows San Francisco must realize that in the first tumble of the tenement house district south of Market Street many little crazy structures must have gone by the board. Each of these probably buried its two or three victims, and now the hot rush of flames has gone over the district, so that bodies will be consumed utterly. For this reason it is unlikely that anyone will ever know just how many people were killed. An estimate of the dead grows more and more difficult as the fire goes on.

Not even the parks, the camping ground of the desolate city to-night, have been spared. Golden Gate Park is topped by a round hill, at the top of which there stood a great, open arcade, used as a playground for children. That is in ruins, and the roof of the tropical conservatory, the pride of the park system, is down. In Union Square, where stood the St. Francis Hotel and where many people slept last night before the flames reached it, the Dewey Monument, a high shaft of granite and bronze, has shifted from its base and is leaning like the Tower of Pisa. The troops kept people away from it all last night.

The seat of city government and of military authority has shifted with every shift of the flames. Mayor Schmitz and General Funston are sticking close together and keeping in touch with the firemen, the police, the volunteer aides and the Committee of Safety through couriers.

GUN COTTON USED.

There are louder reverberations along the fire line to-night, and we know from this that the supply of gun cotton and cordite from the Presidio have been commandeered and that the troops and the few remaining firemen are making their last stand at about Van Ness Avenue, which crosses the residence district, to save what remains of the Western Addition. The regular supplies of dynamite and giant powder are already gone, and a requisition was passed into the military authorities early in the day.

Much damage has been done by ignorant, careless and premature use of explosives. This morning, when the fire reached the Municipal Building on Portsmouth Square, the nurses, helped by soldiers, got out

fifty bodies in the temporary morgue and a number of patients in the receiving hospital. Just after they reached the street a building was blown up, and the flying bricks and splinters hurt several of the soldiers who had to be taken to the out-of-door Presidio Hospital with the patients.

And the troops have shut down with iron hands on the city. For where one man was homeless last night five are homeless to-night. With the fire running all along the water front, few have managed to make their way over to Oakland; the people are prisoners in the peninsula.

There were barely enough soldiers to hold the people in last night, and now their work is multiplied by five. They are taking no chances. They are enforcing the rule against moving about, except to escape the flames, and no one absolutely can enter the city who has once left. All this we get second-hand from the refugees who have made their way over by boat and ferry.

SAD PROCESSION COME IN.

The horror of it has spread to Oakland; but we are hardly sensible of it in our contemplation of the greater horror behind that cloud of smoke. National Guardsmen, realizing the danger caused by the refugees piling up in Oakland, have put us also under practical martial law. Rooms in hotels would sell at ten times their regular price were there any to sell. There are few instances of extortion in this respect; the people in their present temper would not stand it. But every few minutes there float through the suburbs into town those processions of miserable, smoke-blackened, haggard, weeping people.

Now and then you recognize some man, dressed like a tramp, dirty, dragging a miserable woman, as a prosperous business man or a sleek clerk whom you have known in San Francisco. They come to us hungry, mainly penniless, fairly begging something to eat from the public kitchens which the soldiers have set up in the streets. Public halls, the basements of churches and the squares have been set apart for their use. Such houses as have accommodations to spare are being used for the sick, the wounded and the scorched who are arriving every hour.

In addition to those injured by falling walls and by fire, many frail women and delicate children have broken down with exhaustion and with

actual disease caused by the exposure. News came of one woman who has been dragged from park to park since the first shock and who was finally got out by boat last night, dying to-night with her new-born child, of a little girl dead with pneumonia, of a man suffering from internal injuries who succumbed on the boat on the way over.

Such was the pitiful story of agony and death that this eye-witness narrated. San Francisco sat in the waste of her ruins awaiting the time when the flames that had already taken out her vitals should have worn themselves out through the very lack of that fuel. Hope was gone. The whole city seemed doomed. With black ruin covering more than seven square miles in its very heart, the city now waited in a stupor the inevitable reign of starvation and possible anarchy that must crowd close upon the disaster. The flames were eating out the central residence portion about the Western Addition and fashionable Pacific Heights.

After sucking dry even the sewers, the fire engines were either abandoned or moved to the outlying districts in the vain hope that the water mains broken by the earthquake might be repaired in time to permit of a final stand being made against the whirlwind march of the flames.

"No more dynamite! No more dynamite!" a fireman ran shrieking up Ellis Street past the doomed Flood Building at 2 o'clock Friday morning, and as he ran tears sprang from his smoke-smirched eyes. "No more dynamite!" moaned the crowd that stood in the glare of approaching flames. "No more dynamite and we are lost!"

DUMB, HOPELESS DESPAIR.

So at 2 o'clock, with the explosive exhausted and not a dozen streams of water being thrown in the entire fire zone, the stunned fire-fighters and the stupid people sat still to watch the remnant of the city burn. There was no help. Water gone, powder gone, hope even now a fiction, the fair city by the Golden Gate was doomed to be blotted from the sight of man.

The stricken people, who wandered through the streets in pathetic hopelessness and sat upon their scattered belongings, reached the stage of dumb, uncaring despair. A city dissolving before their eyes had no significance longer.

Marius sitting among the ruins of Carthage saw not such a sight as presented itself in the dim haze of the smoke pall across the bay. Ruins, stark naked, yawning at fearful angles and pinnacled into a thousand fearsome shapes marked the site of what was three-fourths of the total area of the city.

There was no business quarter—it was gone. There was no longer a hotel district, a theatre, a place where night beckoned to pleasure. Everything gone. Only a part of the residence domain of the city remained, and the jaws of disaster were closing down on that with relentless determination. All of the city south of Market Street, even down to Islais Creek and out as far as Valencia Street, was a smouldering ruin.

Into the Western Addition and the Pacific Avenue heights three broad fingers of red were feeling their way with a speed that foretold the destruction of a major part of the palaces of the city. There was no longer a downtown district. A blot of black spread from East Street to Oaklavia and bounded on the south and north by Broadway and Washington Streets and Islais Creek, respectively.

GRIM, BLACKENED RUINS.

Not a bank stood. There were no longer any exchanges, insurance offices, real estate offices, all that once represented the financial heart of the city and its industrial strength. Go up Market Street from the Ferry Building to Valencia Street and nothing but the black fingers of jagged ruins point to the smake blanket that presses low overhead. Visit what was once California, Sansome and Montgomery Streets and you must ask a fireman to direct you out of the labyrinth of grim, blackened walls.

Chinatown is no more. Union Square is a barren district. The Call Building is head above the ruin like some leprous thing, with all its windows like staring eyes that look upon nothing but a wilderness. The great Flood Building is a hollow shell. The St. Francis Hotel, one time place of luxury, is naught but a box of stone and steel.

Yet the flames leaped on exultantly. They danced, they roared, in bacchanalian glee. They leaped chasms like a waterfall taking a precipice. Now they were here, now there, always passing on, on to the west and through to the end of the city.

Nob Hill the people of San Francisco call that first rise to the long abrupt hill which tops the city. Here, along two blocks of California Street, in the first flush of the wild middle period of San Francisco history, the Crœsuses of the time built homes as pretentious as any in the country. Ill luck seemed to folow them. In few of the houses did the owners live for more than a short time, and three of the greatest have passed into the hands of public institutions.

From the edge of Chinatown, marked by old St. Mary's Church, the California Street hill rises so abruptly that walking is difficult, and the only common carrier which can climb it is a San Francisco cable car. At Taylor Street it turns into a false summit and the street runs about level for two or three blocks. On the shoulder of this hill stood the Stanford mansion, a square three-story house of gray stone, built by Senator Stanford in the seventies. At the time when he was United States Senator from California he and Mrs. Stanford entertained lavishly.

Then followed the death of their son, the retirement of Mrs. Stanford from society, and the founding of the Leland Stanford, Junior, University. After 1890 the house was hardly ever occupied, the Stanfords living at their country estate in Menlo Park or abroad. In her late life Mrs. Stanford gave one or two receptions there for the alumni and faculty of Stanford.

MAGNIFICENT GIFT TO THE UNIVERSITY.

When, before her death, Mrs. Stanford turned over her whole property to the university, she gave this mansion, too, stipulating that she should have possession of it during her lifetime. After that it was to be used as an allied college of Stanford. The trustees had been debating ever since her death upon a proper use for it. The probability is that it would have been used as the foundation of a medical school, which Stanford now lacks.

The next house up the street, and the greatest of its time in San Francisco, was the Mark Hopkins house. This, too, belonged to a university, for in the last ten years the University of California has held it as an art school. It was a great castle of dark gray stone, which stood above the city like a citadel.

It occupied a block of land of its own, and the fall of the hill on that block is very abrupt. Below it, on the lowest point of the land, were the old stables, so set that a stone thrown level from the lowest basement door would fall on the roof of the stables. Set on the side hill, it varied in height, but on its highest side was five stories. It was topped by a tower, from which there was a magnificent view on all sides of San Francisco Bay.

The Hopkinses never entertained so lavishly as the Stanfords. After the death of Mark Hopkins his widow remarried, went East, and finally, carrying out the wishes of both her husbands, she gave the building to the University of California as an art school. In the basement and stables the university has maintained the best art school in the West. The house proper was used mainly for galleries and loan exhibitions. There, every year, the Art Association gave a Mardi Gras ball, which was one of the great social features of the San Francisco winter.

MONEY TO REMAIN IN CALIFORNIA.

Just across the street from the Hopkins and Stanford mansions stood the new Fairmount Hotel. When the Fair will contest was over, Mrs. W. K. Vanderbilt, Jr., and Mrs. Herman Oelrichs, the principal heirs, announced that they would not take the money out of the West. In California James Fair had made his millions, and in California they should remain. Already they owned great parts of the wholesale district, now wiped clean by fire; and a great part of the ready money they invested in the building of this hotel.

It was of white stone, not high, but broad, and it stood on the corner of the hill, so that in the panorama of the hills as one approached on the bay this spot of white was the first thing which caught the eye. It was designed to accommodate about 500 guests in a manner equaling the best that New York could do. When it was started San Francisco people shook their heads and said that it was a folly; yet so great was the prosperity of the city and so great the demand for first-class accommodations that San Francisco men were preparing to lease it and open it, and were even thinking about an addition.

Diagonally across the street from the Hopkins mansion stood the

house of Collis P. Huntington, wide, substantial and elegant. This shared the fate of the others. Huntington built it, lived in it a little time, left it, and came back only for an occasional visit. In the end neither he nor his wife cared for it. Huntington was not popular in California in his later years, but when he died he cast coals of fire on his critics, for he left the house to the people of San Francisco for charity.

His widow and executrix had the idea of making it a hospital for women, but nothing had been decided and the house had stood with drawn blinds since his death. Further down the street were the residences of Henry and Will Crocker. In the latter was the best art collection on the Pacific Coast since the dispersion of the collection of Henry T. Scott. It includes—or included—many fine Corots and several canvases of Millet, including the famous "Man With a Hoe."

Refugees at Oakland from San Francisco told thrilling stories of their awful experiences during the earthquake of Wednesday morning and the fire which followed. Among those who found themselves stranded were John Singleton, a Los Angeles millionaire, his wife and her sister. The Singletons were staying at the Palace Hotel when the earthquake shock occurred.

DOLLAR FOR AN EGG.

Mr. Singleton said of his experience: "The shock wrecked the rooms in which we were sleeping. We managed to get our clothes on and got out immediately. We had been at the hotel only two days, and left probably $3000 worth of personal effects in the rooms. After leaving the Palace we secured an express wagon for twenty-five dollars to take us to the Casino, near Golden Gate Park, where we stayed Wednesday night. On Thursday morning we managed to get a conveyance at enormous cost, and spent the entire day in getting to the Palace. We paid a dollar apiece for eggs and a dollar for a loaf of bread. On these and a little ham we had to be satisfied. We reached Oakland on a ferryboat, and are now trying to get back to Los Angeles."

Mr. Singleton, like thousands of others in Oakland, found himself wtihout funds, and, as there were no banks open and none would be open until Monday, he had difficulty in securing cash until he met someone who

knew him. Persons who found themselves without money in Oakland were numerous, but those who were unable to buy food were being supplied by the local relief committees and by the various churches, which were thrown open to accommodate the homeless from across the bay.

A Western Union telegraph operator who made a tour of San Francisco sent the following report to the East:

"The thousands who spent Thursday night out of doors were fairly comfortable, most of them being sheltered by tents. Considerable distress, however, was caused by a heavy fog which came up during the night, and also by dew. Chinamen are in evidence about the ferry house by the thousands, all of them waiting anxiously to get out of the city, and all of them carrying big bundles. The principal food of those who remain in the city is composed of canned goods and crackers. The refugees who succeed in getting out of San Francisco are met as soon as they enter the neighboring towns by representatives of bakers, who have made large supplies of bread and who immediately deal them out to the hungry people."

TUGS TO RESCUE OF CROWDS.

Michael Williams, city editor of the San Francisco *Examiner,* made the following statement Friday:

"Shortly before 10 o'clock I boarded the Government steamboat 'Governor Sternberg,' having on board members of the San Francisco Relief Committee, under orders from Colonel Reynolds, commander of the Twenty-second Infantry, to commandeer all available tugs along the water front to go to the rescue of at least 10,000 men, women and children congregated in the neighborhood of Meiggs wharf, who were menaced by the march of flames toward Telegraph and Russian Hills and the valley between.

"Around Meiggs wharf there are several huge oil tanks, some of them containing at least 15,000 gallons of oil. If the flames reach these tanks fearful explosions will result. The people were flocking to the wharves and crowding into all available craft."

CHAPTER VII.

FAMINE AND PESTILENCE FOLLOW EARTHQUAKE AND FIRE.

OVER the smoking remnant of what was San Francisco hope dawned on the mornig of the third day. The ordeal of earthquake and fire had been passed. The perils of famine and pestilence remained to be faced, but the sons of the pioneers of forty-nine were facing them with undaunted hearts.

For lack of fuel on which to feed, the miles of flame were gradually burning themselves out. They had eaten out the city's heart and had spared perhaps one-fourth of its outlying area. All else was a waste of ashes and tumbled masonry.

Huddled in camps of refuge, bivouaced under the billowy smoke from their burnig homes, San Francisco's wealthy and poor alike arose from a night of horror such as few cities have witnessed since Nero burned Rome. Those who slept had slept the heavy sleep of exhaustion. It was a night haunted by a thousand terrors and punctuated by the crack of the rifle. The soldiers guarding the treasure vaults of the United States Mint and of the ruined bank buildings were alert. During the night they shot and killed no less than fourteen men who were seen prowling about, intent upon robbery.

Joseph M. Myers, a local policeman, disputed the authority of a national guardsman who had told him to move on. There was a brief altercation. Then the soldier ran Myers through with his bayonet and killed him.

From the three-story lodging house at Fifth and Minne Streets, which collapsed Wednesday morning, more than seventy-five bodies were taken. There were fifty other dead bodies in sight in the ruins. This building was one of the first to take fire in Fifth Street. At least one hundred persons were killed in the Cosmopolitan, in Fourth Street. The only building standing between Mission, Howard, East and Stewart Streets, is the San Pablo Hotel, which is occupied and running.

The shot tower, at First and Howard Streets, was gone. This landmark was built forty years ago. The Risdon Iron Works was partly destroyed. The Great Western Smelting and Refining Works escaped damage, also the Mutual Electric Light Works, the American Rubber Company, the Vista Gas Engine Company and Folker Brothers' coffee and chop house.

On entering his home in the early morning a policeman named Flood encountered a strange man, who attacked him like a maniac. Flood shot the intruder dead. A special policeman named Enyder also killed a man, but the details were not known. In the chaos and despair of the night such passing tragedies attracted scant notice.

Not less than fifty men paid with their lives the penalty either of their cupidity or their indiscretion. One was shot by a guard for washing his hands in drinking water, a commodity that was being husbanded as sacredly as though it were molten gold. Another, who was a bank clerk, was shot by a soldier while searching after nightfall amid the ruins of the bank in which he had been employed.

NIGHT OF FRIGHTFUL HORRORS.

When dawn again revealed the relics of the ruined city, it ended a night of horrors such as few cities have ever endured in time of peace. Homeless and destitute, three-fourths of the populace had slept upon the ground of the city's parks and squares. Misery had leveled all ranks. Women and children reared in luxury had gladly lain down on a pallet of straw, thankful if a bit of canvas could be had to stretch above them and screen them from the drifting smoke.

Men whom their friends counted wealthy foraged in the morning for a cup of coffee and a roll to stay the hunger of their dear ones. In doing so they rubbed elbows with sodden beggars and with the outcast women of Chinatown.

Golden Gate Park was the Mecca of the destitute. This immense playground of the municipality had been converted into a vast mushroom. It looked like one of those fleeting towns located on the border of a government reservation about to be opened to public settlement. There the common destitution and suffering had wiped out all social, financial and

racial distinctions. The man who was a prosperous merchant was occupying with his family a little plot of ground that adjoined the open-air home of a laborer.

The white man of California had forgotten his antipathy to the Asiatic race and was maintaining friendly relations with his new Chinese and Japanese neighbors. The society girl who on Tuesday night was a butterfly of fashion at the grand opera performance was assisting some factory girl in the preparation of her crude breakfast.

ALL RANKS LEVELED.

Money had little value. Society for the time being had drifted back into primitive conditions. Food and shelter were its first and greatest needs. The family which had foresight to lay in the largest stock of foodstuffs on the first day of the disaster was rated highest in the scale of wealth. A few of the families who could obtain willing expressmen were possessors of cooking stoves, but more than ninety-five per cent. of the refugees were doing their cooking on little campfires made of brick or stone. Kitchen utensils that the week before would have been regarded with contempt were articles of high value.

Many of the homeless were in possession of comfortable clothing and bed covering, but the great bulk of them were in need. The grass was their bed, and their daily clothing their only protection against the penetrating fog of the ocean or the chilling dew of the morning. Fresh meat disappeared Wednesday morning and canned foods and breadstuffs were the only victuals in evidence.

Not alone were the parks the places of refuge. Every large vacant lot in the safe zones had been pre-empted, and even the cemeteries were crowded. A well-known young woman of social position, when asked where she had passed the night, replied, "On a grave." Hundreds of other homeless women and children slept upon bundles of hay on the wharves or on the sand lots near North Beach, some of them under little improvised tents made of sheeting, which poorly protected them from the chilling winds that swept in from the bay.

At the foot of Van Ness Avenue, on the hot sands of the hillside overlooking the bay east of Fort Mason, sat a woman with four little

children, the youngest a girl of three; the eldest a boy of ten. They were destitute of water, food and money. The woman had fled with her children from a home in flames in the Mission Street district and had tramped to the bay in the hope of sighting the ship, which she said was about due, of which her husband was the captain. Helpless and dazed, she huddled her children to her breast and refused to move.

"He would know me anywhere," she said. She would not leave her vigil, although a young man gallantly offered the shelter of his tent, back on a vacant lot.

TEAMS FIFTY DOLLARS AN HOUR.

It was impossible to obtain a vehicle, except at exorbitant prices. One merchant engaged a teamster and horses and wagon, agreeing to pay fifty dollars an hour. Charges of twenty dollars for carrying trunks a few blocks were common. The police and military seized teams wherever they required them; their wishes were enforced at revolver point if the owner proved indisposed to comply with the demands.

Mayor Schmitz looked weary, but he was energetically at work at his desk, though he had had little or no sleep. A policeman reported that two grocery stores in the neighborhood were closed, although the clerks were present.

"Smash the stores open," ordered the Mayor, "and guard them!"

Care of the three hundred thousand homeless, hungry refugees gathered in the city's public squares and parks was now the main problem the local authorities have to solve. They must be fed, and bread, meat and drink in sufficient quantities were lacking, though the leading cities and towns throughout the country were exerting themselves to lend assistance and provisions were now being rushed toward them from many points.

Three relief stations for the homeless were established by the general committee. These stations were the temporary homes of the homeless. They were at Golden Gate Park, Presidio and San Bruno Road. By order of the Mayor and the general committee all remaining stores were entered by the police and their goods were confiscated for distribution under police supervision. Caravans of provisions were on their way to the three relief stations.

In the meantime the hills and beaches of San Francisco looked like an immense tented city. For miles through the park and along the beaches from Ingleside to the sea wall at North Beach the homeless were camped in tents, makeshifts rigged up from a few sticks of wood and a blanket or sheet. Some few of the more fortunate obtained vehicles, on which they loaded regulation tents, and they were therefore more comfortably housed than the great majority.

HOMELESS AND HUNGRY.

Golden Gate Park and the Panhandle looked like one vast camping ground. Fully one hundred thousand persons, wealthy and poor alike, sought refuge in Golden Gate Park alone, and nearly two hundred thousand more bivouaced at the other places of refuge. Relief work was started early. Thousands of refugees were in line in the morning before the California Street bakery. The police and military were present in force, and each person was allowed only one loaf. The Young Men's Hebrew Association's Hall, near Golden Gate Park, was stocked with provisions for the use of the needy victims in the adjacent fields.

Thousands of members of families were separated and with no means of learning one another's whereabouts. The police opened up a bureau of registration to bring relatives together. Heroic deeds, many of which will never be known to the world, were done hourly. The overworked firemen, beaten back repeatedly, made helpless by lack of water, never surrendered. Hundreds of them worked on untiringly, without sleep and without food, fighting in a forlorn hope.

Portsmouth Square became for a time a public morgue. Between twenty and thirty bodies were laid side by side upon the trodden grass in the absence of more suitable accommodations. When the flames threatened to reach the square the dead, most of whom were unknown, were removed to Columbia Square, where they were buried when danger threatened that quarter.

Out at the Presidio soldiers pressed into service all men who came near and forced them to labor at burying the dead. So numerous were the bodies piled up that they were becoming a menace, and early in the day the order was issued to bury them at any cost. The soldiers were

needed for other work, so, at the points of rifles, the citizens were compelled to take up the work of burying the dead. Some objected at first, but the troops tolerated no trifling, and every man who came within reach was forced to work at least one hour. Wealthy men, unused to physical exertion, labored by the side of workingmen, digging trenches in which to bury the dead. Many remained unburied, and the soldiers were still pressing men into service.

Friday and Saturday were made legal holidays, so as to give the bankers of San Francisco time to be in a position to meet the demands of the depositors. The danger of a financial crisis, it was believed, would be averted. The State and banks of the United States in general telegraphed guaranteeing support to local financial institutions, and arrangements were made whereby it could be stated every depositor would be paid in full.

LOSSES OF INSURANCE COMPANIES.

Insurance companies took up the question of losses. It was stated that the companies had decided, if possible, to pay dollar for dollar on all the losses, whether occasioned by fire or earthquake. This will mean, if the loss totals $200,000,000, as it is believed it will, that $110,000,000 will be paid into the pockets of San Francisco realty owners, and with this as a start new structures will soon be in course of erection on the sites of old.

The Firemen's Fund and the Home and Marine, both local corporations, will, it was said, be the principal sufferers. The losses are divided among eighty insurance companies, and it is stated authoritatively all claims will be satisfactorily adjusted, and that no company will be so weakened that it will be forced to suspend. The Pacific Coast managers of the fire insurance companies which suffered by the fire met in Oakland to discuss the situation.

The *Call* said that a prominent president of one of the San Francisco banks had wired directions to his manager to place $3,000,000 in the hands of the Citizens' Relief and Restoration Committee, to be used at its discretion in the work of attending the immediate wants of the stricken people. Subsequent subscriptions added $191,500 to the fund.

Another series of fatalities occurred, caused by the stampeding of a herd of cattle at Sixth and Folsom Streets. Three hundred of the panic-stricken animals ran when they saw and felt the flames and charged wildly down the street, trampling under foot all who were in the way. One man was gored through and through by a maddened bull. Several others were killed.

Explosions of sewer gas wrecked many streets and caused needless alarm among people, who mistook the upheavals for further earthquakes. A Vesuvius in miniature was caused by such an upheaval at Bryant and Eighth Streets. Cobblestones were hurled twenty feet upward and a cloud of sand filled the air. The work of clearing up the debris began at the water front in the business section. One hundred men were employed, under the direction of the Street Department.

FLIGHT OF THE HOMELESS.

Thre was no cessation in the exodus from the stricken city. All who could get away were leaving by whatever means they found possible. The ferry house presented a fearful scene. It was filled with women and children, who have but few articles that they have saved from the ruin. They were waiting to leave the city by the first boat they could get. The road leading to the ferry north and around the shore of the bay as far as Fort Mason was littered with all sorts of vehicles that were broken down under their loads. They consisted of baby carriages, wheelbarrows and toy carts that were too weak to stand the weight of the freight with which they were loaded in going over the rough roads. Some of the abandoned vehicles still contained the effects of the fugitive citizens.

The chief operator of the Western Union wired from the ferry house this message:

"General Funston is giving out thousands of tents and is doing everything possible to relieve suffering. I had an escort take me through the parks last night. The people seeking safety there were fairly comfortable, but the heavy fog and dew at night are causing great distress. Tens of thousands of refugees are flocking into Oakland, Alameda and the other towns across the bay. They had been without food or water since the outbreak of the fire. All the bakeries in the small towns are being worked

to their fullest capacity. The people still in the city are living on what canned stuff they can obtain, with a limited number of crackers.

"The Chinese, whose settlement was destroyed by the flames last night, are in evidence by the thousand this morning. They carry big bundles and are waiting for the first boat to get to a place of safety."

Residents of Oakland, Alameda and other cities across the bay extended hospitality to refugees, who were coming in from the city by the thousand. In addition, churches and large halls were thrown open for their accommodation, a privilege of which many of the homeless and wornout sufferers gladly took advantage.

FUNSTON FEARS FAMINE.

General Funston telegraphed to Washington this message, with the request that it be given wide publicity:

"Army headquarters has been established at Fort Mason, California. All clerks of department and division headquarters, as well as those of the various departments of the army that have not yet reported for duty to their respective chiefs, are requested to report at division headquarters, Fort Mason, as soon as possible."

To feed and house the unfortunate residents of San Francisco who have suddenly been bereft of homes and means of livelihood is calling forth the best efforts of all persons in the City of Oakland. It was calculated that at least two hundred thousand persons had come to that side of the bay and were distributed among the homes of Oakland, Alameda and Berkeley. While hundreds found lodging with friends, there were the countless poor, who were dependent upon charity. The work of evolving a system for supplying the immediate wants was a matter in the process of organization. To get some sort of a scheme whereby those in need could get the necessities of life was the work of Governor Pardee, his staff, Mayor Mott and the local city government and civic organizations.

It was the general belief, however, that, despite all efforts, there would be great distress and that actual starvation stared many in the face unless immediate and whole-souled aid was forthcoming. The supply of food might last out the week, and then, unless it were received in large quantities, the city would be in a state of want.

Immense amounts of supplies were consumed in the fire in San Francisco, which was the distributing point for the cities about the bay and interior towns. This supply was swept out of existence, and what the resources of the State are was a matter that was the chief concern of those engaged in the relief work. The seizure of supplies coming in on the trains by the Relief Committee was authorized by Mayor Schmitz.

Edwin Stearns, chairman of the Executive Committee, seized a carload of flour containing 814 sacks. Of this amount twenty-five sacks were immediately sent to Idora Park, where there were a large number of homeless. Another twenty-five sacks were sent down to Adams Point, where the people were encamped under the trees. A carload of ice was also seized for the hospitals. A carload of potatoes was also taken.

It is not the purpose of the committee to confiscate these goods, and the names of the consignees were taken in each case, and as soon as there were any funds available they would be paid for. The emergency, however, was such that prompt and firm action in the matter was deemed necessary. Besides these seizures, Livermore sent in a wagon load of butter to the committee.

SUPPLIES FAST COMING.

Other cities were sending in supplies, and it was hoped the amounts would be sufficient. The supply station in Thirteenth and Franklin Streets was emptied as fast as goods were received. The demands could not begin to be supplied, and what would result when the stores of the city were empty was a matter past conjecture. Mayor Mott addressed a circular to the bakers of the cities of Oakland, Alameda and Berkeley, requesting them to continue work regardless of holidays.

The bakers agreed to work their plants to their utmost capacity and to send all their surplus output to the Relief Committee. By working day and night it was believed thousands of loaves could be furnished daily. At the headquarters of the Relief Committee the actual detail of the work was being handled by committees, who had charge of the various branches of the work. There was a registration bureau, where all were asked to register their names for the use of those wishing to find families or friends. Hundreds of inquiries were received for information. In hurried flights

many families were separated and were at a loss to know in what direction to look for each other. The churches of the city were taking charge of the work of administering to the wants of the needy and hungry.

THE GREAT DESTROYERS.

Earthquake, fire, famine and sudden death—these are the destroyers that men fear when they come singly; but upon the unhappy people of California they came all together, a hideous quartette, to slay human beings, to blot from existence the wealth that represented prolonged and strenuous effort, to bring hunger and speechless misery to three hundred thousand homeless and terror-stricken people.

After three days the full measure of the catastrophe could hardly be taken. The summary could not be made amid the panic, the confusion, the removal of ancient landmarks, the complete subversion of the ordinary machinery of society. When chaos came again, and all the channels of familiar life were closed, and human anguish grew to be intolerable, compilation of statistics was impossible, even if it were not repugnant to the feelings. That so much was told—that narratives so graphic and so comprehensive should have been sent out to a compassionate world was wonderful. The service thus performed makes mankind a debtor to that press, often reviled and always undervalued, which did so much with conditions so harsh and discouraging.

Other frightful catastrophes the world has known. The earthquake which dropped Lisbon into the sea, in 1755, and in a moment swallowed up twenty-five thousand people, was perhaps more awful than the convulsion which brought woe to San Francisco. When Krakatoa Mountain, in the Straits of Sunday, in 1883, split asunder and poured across the land a mighty wave, in which thirty-six thousand human beings perished, the results also were more terrible.

The whirlwind of fire which consumed St. Pierre, in the Island of Martinique, and the devastation wrought by Vesuvius need not be used for comparison with the tragedy in California, but they may be referred to that we may recall the fact that his land of ours is not alone in its afflictions.

But since the Western Hemisphere was discovered there has been in

this quarter of the globe no violence of natural forces at all comparable in destructive fury with that which was manifested upon the Pacific Coast on April 18th.

The earthquake in San Francisco, which crumbled strong buildings as if they were made of paper, would have been terrible enough; but afterward came the horror of fire and of imprisoned men and women burned alive, and then was added the suffering of multitudes from hunger and exposure.

Public attention was fixed on the great city of San Francisco, but smaller cities in California have had their days and nights of destruction, horror and misery. Some have been almost destroyed; others were partly broken, and without their borders, over a wide area, the trembling of the earth has toppled houses, annihilated property and transformed riches into poverty.

LOSS OF LIFE VERY GREAT.

The loss of life is very great. The money loss can never be computed, for the appraised value of the wrecked property will convey no notion of the consequences of the almost complete paralysis, for a time, of the commercial operations by means of which men and women earn their bread. We sincerely hope that the results of this overpowering calamity may not result in the future embarrassment of those who were allied in business matters with the interests centered in San Francisco. The sensitive nerves of commerce in our day reach far out over the world.

When the weakness and the folly and the sin of men bring woe upon other men, there are plenty of texts for the preacher and no scarcity of earnest preachers. But here is a vast and awful catastrophe that has befallen from an act of Nature apparently no more extraordinary than the shrinkage of hot metal in the process of cooling. The consequences are terrifying in this case because they involve the habitations of half a million people; but, no doubt, the process goes on somewhere within the earth almost continuously, and it no more involves the theory of malignant Nature than that of an angry God.

If we shall contemplate it, possibly we may be helped to a profitable estimate of our own relative insignificance. We think, with some notion

of our importance, of the thousand million men who live upon the earth; but they are a mere handful of animate atoms in comparison with the surface, let alone the solid contents, of the globe itself.

We are fond of boasting in this later day of man's marvelous success in subduing the forces of Nature; and, while we are in the midst of exultation over our victories, Nature tumbles the rocks about somewhere within the bowels of the earth, and we have to learn the old lesson that our triumphs have not penetrated farther than to the very outermost rim of the realms of Nature.

A few weak, almost helpless, creatures, we millions of men stand upon the deck of a great ship, which goes rolling through space that is itself incomprehensible, and usually we are so busy with our paltry ambitions, our foul transgressions, our righteous labors, our prides and hopes and entanglements, that we forget where we are and what is our destiny. A direct interposition from a Superior Power, even if it be hurtful to the body, might be required to persuade us to stop and consider and take anew our bearings, so that we may comprehend in some larger degree our precise relations to things. The wisest men have been the most ready to recognize the beneficence of the discipline of affliction. If there were no sorrow, we should be likely to find the school of life unprofitable.

DEVELOPMENT OF HUMAN SYMPATHY.

For one thing, the school wherein sorrow is a part of the discipline is that in which is developed the human sympathy that is one of the finest and most ennobling manifestations of the Love which is, in its essence, divine. In human life there is much that is ignoble, and the race has almost contemptible weakness and insignificance in comparison with the physical forces of the universe.

But man is superior to all these forces in his possession of the power of affection; and in almost the lowest and basest of the race this power, if latent and half lost, may be found and evoked by the spectacle of the suffering of a fellow-creature.

The human family looks on with pity while the homeless and hungry and impoverished Californians endure pang. Wherever the news went, by the swift processes of electricity, there men and women, some of them,

GREAT CONFLAGRATION IN SAN FRANCISCO AFTER THE TERRIBLE SHOCKS OF THE EARTHQUAKE HAD SHATTERED AND RUINED MANY OF THE TALL BUILDINGS.

Photograph showing the terrible effects of the earthquake and fire in one of the principal streets of the stricken city.

FIRST BAPTIST CHURCH OF OAKLAND, which is just across the bay from San Francisco. This photograph shows the force of the earthquake.

TERROR-STRICKEN CELESTIALS FLEEING FROM CHINATOWN WHILE BUILDINGS WERE CRUMBLING FROM THE SHOCKS OF THE EARTHQUAKE.

THOUSANDS OF REFUGEES LIVING IN GOLDEN GATE PARK, SAN FRANCISCO.

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VIEW FROM VALLEJO STREET, looking down Kearney towards Market.

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LOOKING TOWARD THE FERRY from Vallejo Street. On the roof in the foreground can be seen a group watching the destruction of their city.

VICTIMS OF THE SAN FRANCISCO HORROR COOKING THEIR MEALS IN THE STREETS.

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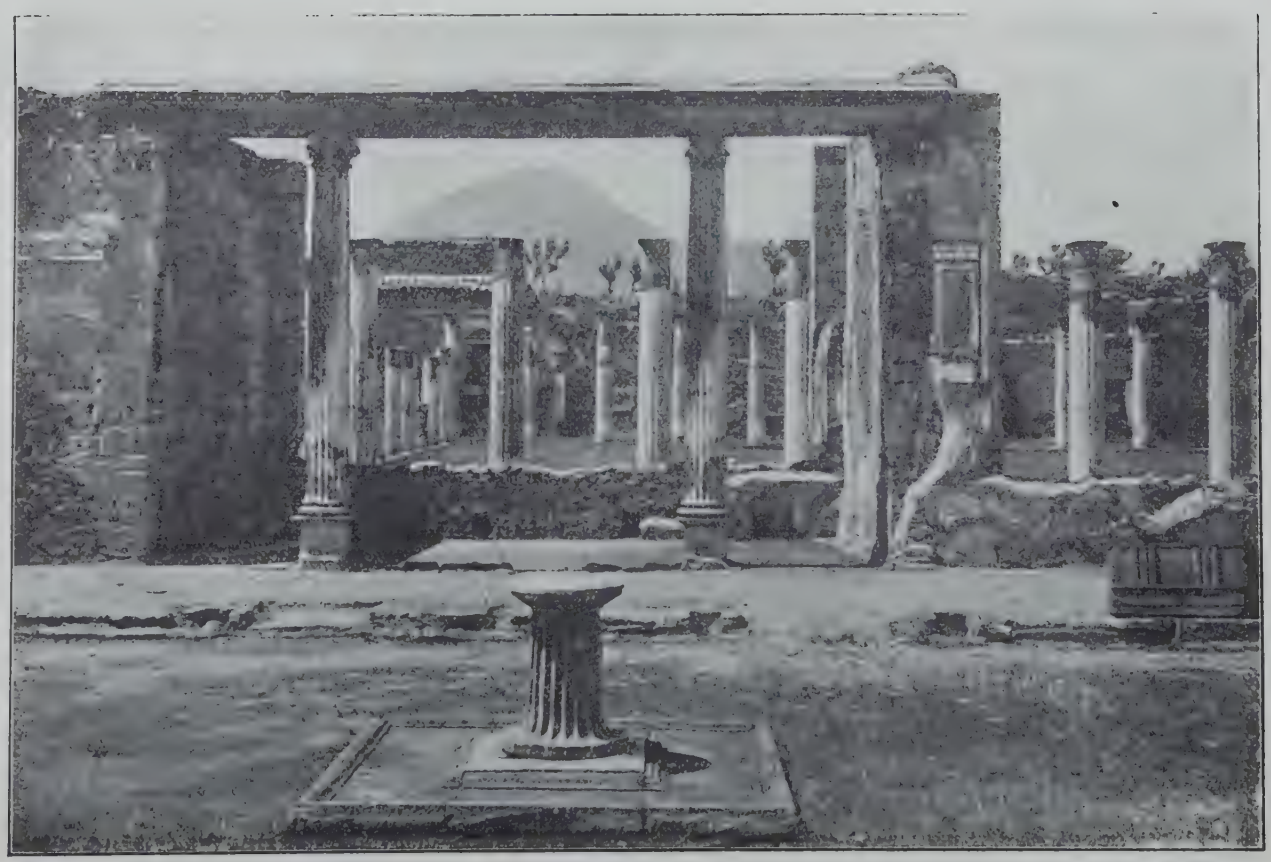
MAN KILLED IN MARKET STREET. This is a ghoul, or robber, who was shot by soldiers for robbing a victim of the earthquake. The body of the robber was afterwards burned, and only fragments of his bones were left.

SCENE IN THE CENTRE OF THE RUINED CITY

THE HORRORS OF THE SCENE—THE TERRIBLE REALITIES OF DEATH—ARE ALL SHOWN IN THE PICTURE WHICH TELLS THE STORY OF THE VOLCANO'S WORK

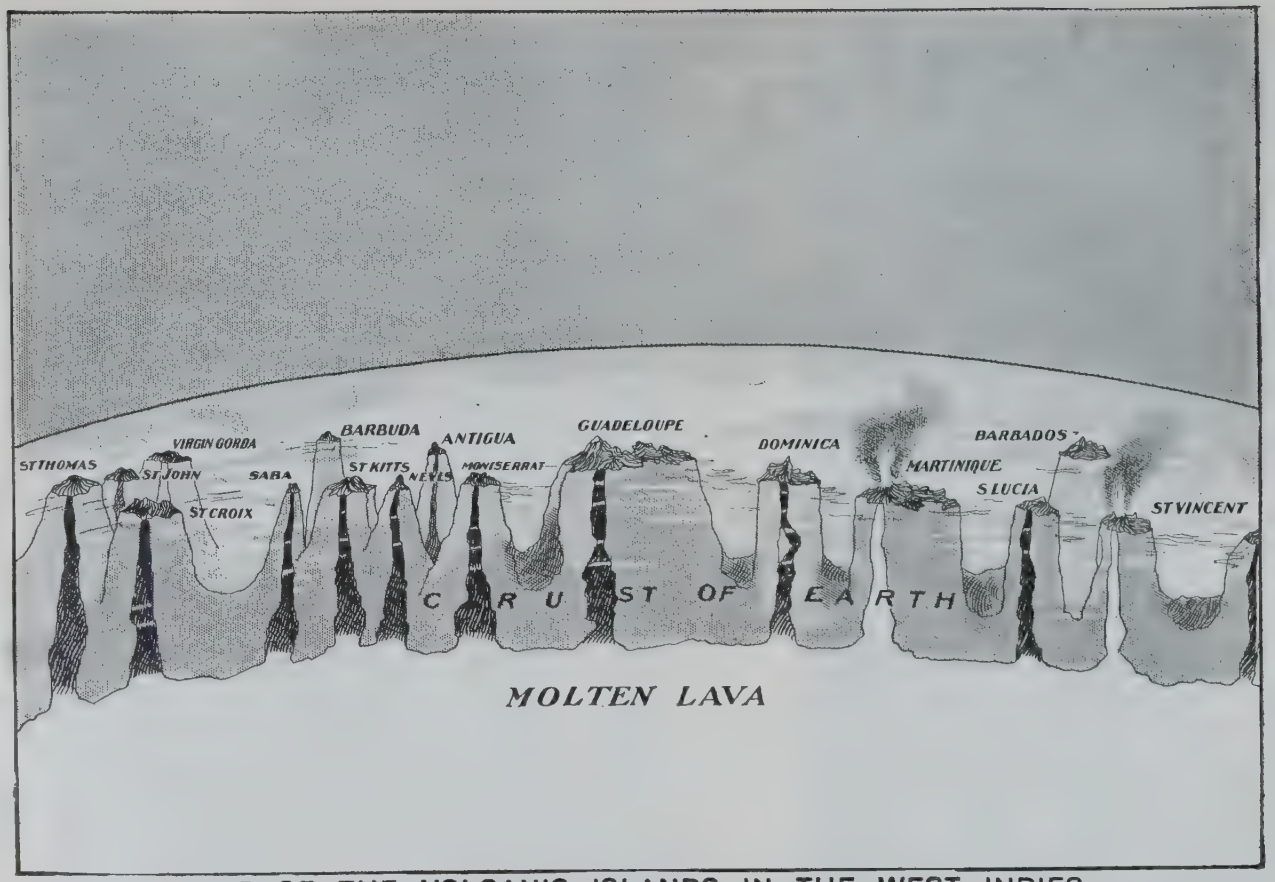
SCENE IN POMPEII SHOWING STREET OF SEPULCHRES



RUINS OF HOUSE OF THE FAWN, POMPEII—SHOWING MOUNT VESUVIUS IN THE DISTANCE

EXCAVATED PORTION OF THE STREET CALLED STRADIA IN POMPEII, WHICH WAS BURIED UNDER THE ASHES

BIRD'S-EYE VIEW OF NAPLES SHOWING MOUNT VESUVIUS IN THE DISTANCE



MAP OF THE VOLCANIC ISLANDS IN THE WEST INDIES

WHEN THE MOLTEN LAVA COMES IN CONTACT WITH WATER THE RESULTING STEAM CAUSES
EARTHQUAKES AND UPHEAVALS OR VOLCANIC ERUPTIONS

SCENE OF THE TERRIBLE CALAMITY IN MARTINIQUE WHICH CAUSED THE DESTRUCTION OF ST. PIERRE

THE CRATER OF MOUNT SOUFRIERE, ST. VINCENT, THE ERUPTION OF WHICH DEVASTATED MUCH OF THAT ISLAND

perhaps, hardly knowing where California is, were sorry and willing and eager to help. There are fights within the family sometimes, when nation wars with nation, and all love seems to have vanished; but the world is, in truth, akin. "God hath made of one blood all the nations of the earth," and the blood "tells" when suffering comes.

The only thing that most men can do in this hour of trial is to send the money that means speedy succor from want, and from all civilized lands money has come in generous quantities. But however large the stream might be, there would never be enough to fill all the need; and so we can appeal for more and more, each man giving a little, if he can give but a little, in the hope that the California, from which our first great flood of gold came sixty years ago, may have some of her treasure back again in the time of her great extremity.

CHAPTER VIII.

PRESIDENT CALLS FOR AID AND CONGRESS MAKES A GENEROUS APPROPRIATION.

PRESIDENT ROOSEVELT on Thursday called upon the people of the entire nation to join in giving aid to the stricken city of San Francisco. Congress adopted unanimously and with promptness a resolution appropriating $1,000,000 for relief work, and the governmental departments, led by the War Department, were busy day and night perfecting and making effective the plans for relief.

PRESIDENT'S PROCLAMATION.

The President's proclamation was issued after a conference with Miss Mabel Boardman, of the American Red Cross. It follows:

"In the face of so terrible and appalling a national calamity as that which has befallen San Francisco, the outpouring of the nation's aid should, as far as possible, be entrusted to the American Red Cross, the national organization best fitted to undertake such relief work. A specially appointed Red Cross agent, Dr. Edward Divine, starts to-day from New York for California to co-operate there with the Red Cross branch in the work of relief.

"In order that this work may be well systematized, and in order that the contributions which I am sure will flow in with lavish generosity, may be wisely administered, I appeal to the people of the United States, to all cities, chambers of commerce, boards of trade, relief committees and individuals to express their sympathy and render their aid by contributions to the American National Red Cross. They can be sent to Jacob H. Schiff, New York Red Cross treasurer, or other local Red Cross treasurers, to be forwarded by telegraph from Washington to the Red Cross agents and officers in California."

Action for relief was the first work of Congress. The Senate quickly set aside the routine business of the opening and passed a resolution offered by Mr. Perkins, appropriating $500,000 to carry on the work of relief

through the War Department. The resolution was sent to the House, where a substitute, offered by Mr. Tawney, of Minnesota, was adopted, doubling the appropriation. This action was concurred in by the Senate and at 6 o'clock in the evening the President attached his signature.

RESOLUTION OF AID.

The resolution follows:

"*Resolved,* By the Senate and House of Representatives of the United States of America, in Congress assembled, that the Secretary of War is hereby authorized and directed to procure in open market or otherwise subsistence and quartermasters' supplies, in addition to such supplies belonging to the military establishment and available, and issue the same to such destitute persons as have been rendered homeless or are in needy circumstances as a result of the earthquake which occurred April 18th and the attending conflagration; and, in executing this joint resolution, the Secretary of War is directed to co-operate with the authorities of the State of California and the Mayors of the cities of San Francisco, Berkeley, Oakland, Alameda and such other cities on the Pacific Coast as may have sustained damages; be it further

"*Resolved,* That the Secretary of the Treasury, Secretary of the Navy and the Secretary of Commerce and Labor are hereby directed to co-operate with the Secretary of War in extending relief and assistance to the stricken people herein referred to, to the extent of the use of the naval vessels, revenue cutters and other vessels and Government supplies under their control on the Pacific Coast; be it further

"*Resolved,* That to enable the Secretary of War to execute the provisions of this joint resolution there is hereby appropriated out of any money in the Treasury not otherwise appropriated the sum of $1,000,000, to be expended under the direction and in the discretion of the Secretary of War."

Mr. Tawney explained that the larger sum was absolutely needed; that secretaries of other departments were included so that naval vessels, revenue cutters and the Fish Commission's boat "Albatross" could be used. The substitute was reported also on the ground that the amount should be doubled, and the Secretary of War should be relieved from any statutory

provision requiring bids to be received for the needed supplies. The resolution was adopted ten minutes after its introduction.

The resources of all the governmental departments were turned to the work of relief. The Secretary of the Treasury authorized the telegraphic transfer of $10,000,000 from the Sub-treasury at New York to San Francisco. The cash was deposited in New York and immediately paid out on the order of San Francisco banks entitled to the same.

Secretary Metcalf, of the Department of Commerce and Labor, in dispatches to the lighthouse inspector at San Francisco and to the officers of the Fish Commission, directed the lighthouse tender "Madrona" and the United States steamship "Albatross" to go at once to the stricken city and do everything practicable to aid the sufferers. The authorities at the War Department actively carried on the work which had kept Secretary Taft, General Bell and many others up most of Wednesday night, with the object of getting provisions and tents to the sufferers. Secretary Taft's great anxiety was to get food into San Francisco at the earliest moment, and his orders sent in the night were supplemented during the day by others.

PLANS FOR GREAT REFUGE CAMP.

Commissary General Sharp said that he was advised that the supplies could be shipped by rail to a point within thirty miles of San Francisco, and he was of the opinion that it was better to send them there where, as a last resort, a camp for refugees could be established, as all the persons in need of supplies could not remain in the stricken city.

Instructions were sent to Portland and Seattle to buy rations in the open market and hurry them to the stricken city. The orders in all directions were for the purchase of full rations. Candles were included in the supplies on account of the lack of lighting facilities in San Francisco and the surrounding country. Bacon, rice, coffee, sugar, beans and peas formed the greater part of the supplies to be sent. The Presidio and other army posts near San Francisco had only a limited amount of supplies on hand. Consequently the Government could not rely on these supplies to afford more than emergency relief to the thousands in need of food.

Omaha, St. Louis and other Western markets were drawn on to sup-

ply the immediate demands of the sufferers, as it was not thought advisable to exhaust the limited supplies at Western army posts. General Elliott, commandant of the Marine Corps, was informed that the large storehouse of the Marine Corps, on Mission Street next to the theatre, was destroyed, together with its contents, consisting of clothing and other stores to the value of about $100,000.

MESSAGES TO FUNSTON.

General Funston was kept in touch with what was being done to send relief by the War Department. Early Thursday morning Secretary Taft sent this dispatch:

"Your dispatch calling for tents and rations for 20,000 people received. Have directed sending of 200,000 rations from Vancouver Barracks, the nearest available point. Will give orders concerning tents immediately and advise you within an hour. Do you need more troops? Of course, do everything possible to assist in keeping order, in saving life and property and in relieving suffering and hunger by use of troops, materials and supplies under your orders. House passed enabling resolution to-day and Senate will to-morrow. All railway and telegraph facilities surrounding San Francisco reported badly damaged and demoralized. Officers will accompany rations where necessary, in order to insure as prompt forwarding and delivery as possible with orders to keep in touch with you when practicacble."

This was followed shortly after by this message from Taft:

"All available hospital, wall and conical wall tents will be sent at once by express from Vancouver, Douglas, Logan, Russell, San Antonio, Monterey, Snelling and Sheridan. Remainder will be sent from Philadelphia depot. Little definite information thus far received as to limits of burned district or conditions. Wire details as comprehensively as possible."

This telegram was sent by General Bell, chief of staff, to General Funston, by direction of Secretary Taft after a conference between Secretary Taft and Secretary Bonaparte:

"Secretary of War directs me to inform you that the Quartermaster General has been directed to forward to San Francisco all available canvas in the possession of the army. The Commissary General has been directed

to ship 200,000 rations from nearest shipping points. Admiral McCalla, at Mare Island, will be instructed to confer with you, and to furnish all food supplies that can be spared from the stores at Mare Island; also to furnish any available canvas suitable for making improvised shelter."

The Washington Lodge of Elks passed resolutions of sympathy for the earthquake sufferers, and sent a telegram to the San Francisco lodge tendering financial and other assistance. A subscription of $10,000 for the relief was made by Robert Lebaudy, the French philanthropist, through the French Ambassador. This sum was made immediately available through the French Consul in San Francisco. The War Department officers were making estimates of the losses sustained by the Government. The Quartermaster's stores in San Francisco were in rented buildings. and the loss in goods stored there by the Quartermaster's Department was roughly estimated at about $3,500,000.

SYMPATHY FROM THE KAISER.

The German Ambassador, Baron von Speck-Sternburg, called on the President and extended the condolences of the German Emperor. After leaving the White House the Ambassador said:

"The German Emperor has requested me to express to the American people his profound and most sincere sympathy over the terrible disaster which has struck the western part of the United States. The Emperor feels sure that this catastrophe will create widespread sympathy and mourning among the German people."

The following telegram was received at the War Department from William Mason Smith, president of the New Orleans Cotton Exchange:

"Many citizens of New Orleans, represented by the Cotton Exchange, desire to extend the most rapid and useful aid to San Francisco. We see that your department is in touch with General Funston, the Department commander, and we would be glad if you can tell us if we can best help by money or provisions by special train to San Francisco."

Contributions by New York for San Francisco aggregated three-quarters of a million dollars, scarcely more than a day after the terrible catastrophe. Of this sum, it was announced at the Standard Oil Building, John D. Rockefeller subscribed $100,000. The same amount was raised

on the Stock Exchange, $50,000 being pledged within fifteen minutes after the appointment of a collection committee. Mayor McClellan appointed a committee of 100 citizens to solicit contributions for the San Francisco sufferers.

Women leaders of society agreed to lend their influence at patronesses for benefit performances. Subscription lists were also opened on the consolidated Exchange, on the Cotton, the Coffee, the Produce and the Metal Exchanges, and the sums offered reached into the thousands. Mr. Rockefeller made his contribution through his San Francisco agents, to whom he sent a telegraph message to distribute the money among the destitute. No other instructions were given.

C. H. MACKAY'S $100,000 GIFT.

Clarence H. Mackay sent this message to President Wheeler, of the University of California, at Berkeley, Cal.: "I understand that owing to the terrible catastrophe which has just overtaken San Francisco and that part of California, several of the university's buildings have been destroyed. Pray accept my deepest sympathy. I am wiring you to say that I shall be willing to subscribe $100,000 toward the erection of a new building. This is a time for all of us to pull together, and to show the world what California can do under adversity."

Mayor Schmitz issued the following proclamation:

"I congratulate the citizens of San Francisco upon the fortitude they have displayed and I urge upon them the necessity of aiding the authorities in the work of relieving the destitute and suffering. For the relief of those persons who are encamped in the various sections of the city everything possible is being done. In Golden Gate Park, where there are approximately 200,000 homeless persons, relief stations have been established. The Spring Valley Water Company has informed me that the Mission district will be supplied with water this afternoon, between ten and twelve millions daily being available. Lake Merced will be taken by the Federal troops and that supply protected."

Already San Francisco had turned her face resolutely toward the future. The plucky spirit of her citizens was voiced when Mayor Schmitz sent the following telegram to President Roosevelt:

To the President of the United States, Washington:

"Generous contribution of $1,000,000 from the Federal Government for relief of destitute persons received and deeply appreciated. The people overwhelmed by your generosity. All of this money will be used for relief purposes. Property owners determined to rebuild as soon as fire ceases. City will immediately proceed to provide capital for the purpose of reconstructing public buildings, schools, jails, hospitals, sewers and salt and fresh water systems. The people hope that the Federal Government will at once provide ample appropriations to rebuild all Federal buildings on a scale befitting the new San Francisco. We are determined to restore to the nation its chief port on the Pacific.

(Signed) "EUGENE E. SCHMITZ, Mayor."

He also sent the following to Louis Cook, of New York:

"Grateful for your general telegram. California heartily thanks you. We need tents, bedding and food supplies. We require comforters and blankets in large number. Thousands of our people are sleeping in the open air without sufficient covering. We particularly need adequate supplies of disinfectants to establish sanitary camps; also drugs and hospital materials. A committee of fifty has been appointed.

"In your telegram you speak of ready cash. Would suggest that considerable of small denomination be sent. This is important as all our banking quarters are destroyed. We would greatly appreciate if New York bankers would arrange to co-operate with California bankers with a view of securing temporary relief, so that fiscal operations may be resumed at the earliest date possible. San Francisco will rebuild. We want to resume the transaction of our usual business in the shortest time possible."

EPISCOPAL BISHOPS SEND OUT AN APPEAL.

The followng letter, issued by Bishops O. W. Whitaker and Alexander Mackay-Smith, was sent to the clergy of every Episcopal church in Pennsylvania, to be read by them to their congregations:

To the Clergy, Parishes and Congregations of the Diocese of Pennsylvania:

"The appalling calamity which has befallen the people of California

demands instant aid from every humane heart in the country. The President of the United States has issued a proclamation requesting immediate contributions, and, under the advice of the authorities of all the cities and towns and villages, money is being gathered to relieve the distress. In accordance with this wave of popular sympathy which is sweeping through the land, we make our appeal to the warm hearts, and willing hands of Christian people to at once spring to the relief of these sufferers.

"We urge upon you the necessity of making an immediate collection in your parish. To whatever other purpose you may have determined to devote your Sunday collection, we beg that you will put this aside for a moment and send whatever you may be willing to give to aid this pressing necessity. It is the voice of our own brethren that is calling upon us in their hour of trouble, and the reply should be instantaneous.

"We trust that you will give immediate attention to this appeal, so that by the beginning of this ensuing week contributions may begin to pour in from every parish and mission in the diocese.

"In the name of the Merciful Saviour we make this appeal, trusting that even the very children may be inspired to give their pennies to help our brethren in an hour of trial almost unparalleled in the history of the world.

"Your friends and bishops,

"O. W. WHITAKER,
"ALEX. MACKAY-SMITH."

Responding to the call of San Francisco and her sister cities, the people of the United States, through State and municipal governments, various fraternal and charitable organizations, and as individuals, poured out their riches for the relief of the earthquake sufferers.

The War Department advised Secretary Taft that another million dollars was needed for the immediate work of the Department in San Francisco. New York, the money centre of the nation, was first in the work of charity, many princely sums having been given to the Relief Committee.

Charles A. Peabody, acting for William Waldorf Astor, sent $100,000

to the Mayor of San Francisco. The Board of Directors of the United States Steel Corporation appropriated $100,000. The Standard Oil Company gave $100,000, in addition to Mr. Rockefeller's private contribution of a like amount. The Harriman railroads jointly contributed $200,000.

From Ottawa came the announcement that the Canadian Government had appropriated $100,000 for the relief work.

The Oriental Consistory of the Mystic Shriners, which met at Chicago, decided that the $100,000 appropriated for the entertainment of the Shriners at the national encampment in Los Angeles be turned over to the relief of the San Francisco sufferers. Among the contributions in New York were $25,000 from William K. Vanderbilt and $25,000 from Kuhn, Loeb & Co. A man who refused to give his name handed $25,000 to Mayor McClellan. In Boston a meeting of representative citizens voted to raise $500,000, and the State Legislature appropriated $100,000. In Chicago a big fund was raised, and several trainloads of provisions were started for San Francisco.

RELIEF WORK WIDESPREAD.

Reports from all over the country indicated the same ready response to the call of charity. Not only were city and State governments appropriating relief funds, but from the cities nearer the scene of the disaster trainloads of canned goods, provisions, meats, tents and clothing were started for the stricken community. The National Federation of Churches sent a call from its headquarters in New York asking that a collection be taken up in the places of worship of all the religious organizations. The National Order of Elks, the Knights of Columbus, the Royal Arcanum, the Modern Woodmen of America and many other fraternal organizations sent out appeals to their members to help the relief work. From every available point by railroad or boat the War Department hurried rations and tents to San Francisco. Every hour the volume of relief funds grew, as there was hardly a city in the United States that was not actively engaged in the work.

Cablegrams were received from Germany to the effect that the North German Lloyd and the Hamburg American Steamship Lines had each contributed $25,000 to the earthquake sufferers.

News from London was that a meeting of Americans, at which Ambassador Reid presided, pledged $100,000. Boston telegraphed $25,000 to a Chicago packing house to have a trainload of provisions shipped at once to San Francisco. The Boston committee also wired to Spokane, Seattle, Kansas City and other Western towns to know what could be done in the way of the immediate shipment of supplies. Bishop Kenny, of the Catholic Diocese of St. Augustine, Fla., Bishop Harlley, of Columbus, Ohio, and other Catholic bishops ordered special collections in all the churches in their jurisdiction for the relief funds.

President Roosevelt and his Cabinet devoted the greater part of their semi-weekly session on Friday to a discussion of the calamity which had befallen San Francisco. It was decided that Secretary Metcalf, who is a resident of Oakland, Cal., should proceed at once to the stricken city as a representative of the National Government. Secretary Metcalf left for San Francisco in the afternoon.

NEWS FROM THE STRICKEN CITY.

Speaker Cannon and Chairman Tawney, of the Appropriation Committee, indicated there would be no delay in granting the appropriation. The following message reached the War Department in the afternoon:

"The latest reliable information from San Francisco is that the residence district from Post to Union Streets and from Octavia Street to the ocean shore is intact, and, it is believed, will be saved. Relief trains are arriving and will greatly mitigate the sufferings."

President Roosevelt sent $1,000 to the Red Cross Committee. Senator Knox, of Pennsylvania, gave $500.

Every available vessel in the vicinity of San Francisco, whether it belongs to the navy, army, revenue cutter service, fish commission or lighthouse service, was directed to carry supplies of every description to the stricken city and render other assistance, while officers of the army on the Pacific Coast and elsewhere were given imperative instructions to ship tents, rations, medical and other relief supplies. Offers of assistance from abroad were very gratifying to the President, but he felt the United States was able to care for the San Francisco sufferers, and contributions from foreign countries would be declined.

Governor Pennypacker, of Pennsylvania, issued the following proclamation calling upon the people of Pennsylvania to contribute to the relief of the San Francisco earthquake sufferers:

In the name and by authority of the Commonwealth of Pennsylvania, Executive Department:

PROCLAMATION.

An overwhelming and heartrending calamity has fallen upon the city of San Francisco and neighboring towns. Homes and property are gone, and the bereft people are helpless amid desolation and want.

Now, therefore, I, Samuel Whitaker Pennypacker, Governor of Pennsylvania, call upon the citizens of this Commonwealth to express their sympathy by sending out of the abundance of their means commensurate contributions to their kindred in distress, and I appeal to all corporations, associations and individuals alike to act with promptitude.

Given under my hand and the great seal of the State, at the city of Harrisburg, this twentieth day of April, in the year of our Lord one thousand nine hundred and six, and of the Commonwealth the one hundred and thirtieth.

By the Governor:

SAMUEL W. PENNYPACKER.
ROBERT W. MCAFEE,
Secretary of the Commonwealth.

The splendid generosity of President Shibe and his fellow officials of the Athletic Base Ball Club, of Philadelphia, swelled by $639.39 the *North American's* fund for the relief of sufferers from the California earthquake. After paying New York's share of the receipts for the game on the local American League grounds the home club turned over to the fund every dollar that had been paid for admission by those on the bleachers and in the grandstand.

To this large sum must be added $23.80, donated by Joe Schroeder, the club's groundkeeper. Mr. Schroeder also had the concession for selling sandwiches, pretzels, peanuts and soft drinks. The $23.80 he turned over represented his entire profits on one day's business. Nobody had appealed

to Joe to perform this act of liberality in behalf of his suffering fellowman. Joe didn't need to be asked. He simply walked up to *The North American's* representative, turned over a bagful of nickels, dimes and quarters, and said:

"Add this to the fund. I'm sorry it isn't more. If my profits had been ten times as much, you'd got it all."

Mr. Rockefeller's $100,000 donation does not represent, in proportion to his means, as much as "Joe's" $23.80. The same generous spirit that marked Mr. Schroeder's act seemed to inspire everybody connected with the club. All officials of the club, paid their way into their own grounds for the first time. The policemen on duty, who were paid by the club, would not accept their wages for the afternoon's work, and requested that it be turned over to the fund.

When the money was paid over the manager said: "We never drew a check in this office that gave us more pleasure."

MILITARY FORCE INCREASED.

In the War Department it was regarded as significant that General Funston had called to his aid all of the troops at Monterey and Vancouver barracks in addition to those which were already at the Presidio. It was estimated that with all of these he would have under his command about 3,500 men, and this number was deemed sufficient by the War Department to insure good order in the city.

Assistant Secretary of the Navy Newberry, who was acting Secretary up to the time of the return of Secretary Bonaparte from Baltimore, sent orders to the Pacific squadron saying that the department expected all naval vessels to afford every aid in their power, and directing them to communicate with the Mayor of Los Angeles. At the same time Rear Admiral Converse, chief of the Bureau of Navigation, ordered the Collier Saturn at San Diego to proceed at once to San Francisco and report to Rear Admiral Goodrich.

Mr. Newberry also addressed a note to the War Department, in which he said that orders had been issued to the navy to assist the army in every possible manner and asked if there was anything further which the navy could do.

Secretary Taft, while testifying before the Canal Committee, received at 3 o'clock a message from the War Department that another $1,000,000 was needed to buy supplies for San Francisco sufferers. The Secretary, after reading the message, said:

"We have already contracted for $1,500,000 worth of stores and expenses incident to the work. This message, of course, should go to the House at once." He stated that he would send it there for action. "If I am guilty of any impeachable offense (referring to the law prohibiting expenditures in excess of appropriations) in connection with this disaster, I shall crave your endorsement of my course," he said, in explanation of his desire to do everything possible for the sufferers without delay. "Congress will acquit you," said Senator Taliaferro, and other members of the committee assented, feelingly.

TO REPLACE FEDERAL BUILDINGS.

When the Senate met on Friday, Mr. Scott presented and asked immediate attention for a resolution calling upon the Secretary of the Treasury to prepare for the Senate an estimate of the cost of replacing the ruined Federal buildings in San Francisco, and it was adopted. There was no objection to and very little discussion of the resolution. Mr. Heyburn suggested the necessity of making immediate provision for the United States Court in San Francisco.

The Andrew Carnegie Hero Fund Commission wired $25,000 to the Mayor of San Francisco for the relief of the earthquake sufferers. The telegram was sent from Philadelphia by President Charles L. Taylor, of the commission, the message being first dispatched to the office of the Carnegie fund, in Pittsburg, with instructions to have it transmitted to its destination. It read as follows:

"Carnegie Hero Fund Commission places $25,000 at your disposal, subject to your order, for immediate relief of sufferers. With deepest sympathy,

"CHARLES L. TAYLOR, President."

The action was decided upon in an informal way by Mr. Carnegie and four members of the commission, all residents of Pittsburg.

"The earthquake was the chief topic of conversation," said President

Taylor afterward, "and the thought of sending immediate relief was naturally uppermost in our minds. No one particular person made the suggestion; it was simultaneous and unanimous."

REMARKABLE ESCAPE.

Eleven post-office clerks, all alive, were rescued on Friday from the ruins of the collapsed post-office building at Oakland, where they had been entombed under tons of stone and timber since the structure fell on Wednesday.

All were at first thought to be dead, but when a rescuing party reached them, after hours of effort, they were found to be alive, though exhausted and unconscious. The structure had collapsed in such a way as to imprison them on all sides without crushing them, heavy timbers having shielded them from the falling masonry. For three days they had been without either food or drink.

They were found by a party of workmen who were trying to recover the mail matter. The post-office was one of the few buildings wrecked by the earthquake shock that was not afterward swept by flames. All the mail matter was recovered, comparatively uninjured.

CHAPTER IX.

THE QUEEN CITY OF THE PACIFIC COAST PARALYZED WITH TERROR AND DISTRESS.

AFTER three long days and nights of indescribable horror, death and disaster, relief came to the stricken people of San Francisco. After a night of blackness and chill, while wild Pacific gales fanned the fiercely burning flames, shattered the crumbling desolate walls of ruined buildings and whistled through the unprotected camps where shivering refugees huddled together, the sun rose gloriously upon a day of hope and promise.

With it came the news that the devastating flames were checked at last; that their work of destruction was over. Relief trains had entered during the night, and when day was fairly broken San Francisco had been fed. The vast camps for the first time in three days became the scene of other than famine and sorrow, and hope sprung anew in the hearts of the hundreds of thousands who passed through the stupendous disaster.

Disease was the single enemy left unconquered. Fire and famine had passed. A thousand cheers from husky parched throats rose when late at night the first relief train puffed in over the Coast Division of the Southern Pacific. Men shouted and women laughed hysterically as they saw the troops crowd about the cars, rip open the doors and reveal the plenty within. It was the turning point from a living death to life. The work of relief had been going on unceasingly all day and continued throughout the night. Nine distributing points were arranged, and the stores were hurried from the trains in every kind of vehicle. Automobiles and wagons were either offered or commandeered, and the puffing motor cars, guarded by soldiers, flashed up and down the rows of ashes and tall steel threads, bringing the food and water, the tents and clothing, which had been sent in from all parts of the United States.

With the break of day, steamers from Oakland, Alameda, Vallejo and other points through which the railroads had means of communication with San Francisco, began landing cargoes of supplies at various points

along the water front from the Potrero to the Presidio. The relief trains had been arriving at frequent intervals, and were unloaded almost before they had stopped. All were assisting in the work, and system was gradually growing out of the chaos which followed the first attempt at distribution.

FEEDING THE GAUNT AND HUNGRY HOST.

Gaunt men waited their turn in the long lines which formed around the stores while the troopers worked with feverish energy that all might be fed. More than twenty carloads of food was received in the city and word had been received that the vast stores which were speeding over the Western plains on express train schedule would arrive next day.

The sight in the relief camps was a remarkable one, one that will never be effaced from the memory of those who saw it. With the rising of the sun the worn men and women rose from their beds of grass and sod and turned an expressionless face toward the ruins of the great city. The flames still burned in a few scattered places, but the resistless sweep of the night before was gone. Tall threads of steel rising high into the heavens marked the ruins of huge skyscrapers; crumbling masses of stone remained of the magnificent buildings which stood but a few hours before. Ashes and waste and desolation were everywhere.

But the brave refugees, with the knowledge that food and water was at hand and that famine no longer threatened, turned a brave face to another day—the first day of hope since the sudden terrifying tremors of the earth Wednesday morning. In half an hour thousands of little fires were burning and the odor of coffee pervaded the camps. To the famished chilled bodies, after their night of terror, it portrayed the beginning of the new era.

All San Francisco breakfasted in the open streets, a few rocks covered with a sheet of tin serving as a stove. Millionaire and pauper, Caucasian and Mongolian, white and black, all ate together. All through the fine residence section of Pacific Heights people sat on the sidewalks and took their black coffee, dry bread, crackers, and in some cases eggs and bacon. For many it was the first food that had passed their lips since the fire started. And San Francisco fed, became once again a city of determina-

tion. Men who had remained in a stupor for hours smiled, children cooed once again, tired women rose with new hope.

The flight, checked by the flames which threatened the Union Ferry House, again commenced. A continuous stream of humanity trailed down Market Street through the ruins of what had been their homes and on to the ferryboats, while the bay shore from the north was a moving mass. All day long the refugees who elected to leave the despoiled city fell in with the procession. The terror had gone and the flight was slow and systematic. Troops guarded the docks and the boats ran ceaselessly to and fro with their human freight. All who wished to leave were urged to do so, as every one gone meant one less mouth to feed. None were allowed to take food with them, but all who were destitute were being provided passage to Oakland, and from there were carried free to any point they might wish to reach.

Many were taking advantage of these conditions, and 50,000 left within a few days. Twenty-five thousand escaped before the fire endangered the ferry landing, and fully as many departed the next day. These were going to various points, carrying their all with them. The refugees, were they not pitiful, would have been grotesque. Men with high silk hats and wrapped in blankets, women in underskirts and shawls, their arms and hands bearing thousands of dollars' worth of jewelry, babes with dolls or yelping dogs, and all with hastily tied bundles; all were joining in the exodus. A few of the luckier ones had suit cases.

THOUSANDS STAY IN.

But while thousands left, some to seek new homes, some to visit relatives and some to travel or search for work, many thousands remained in the camps. These were rapidly being fitted up in somewhat better shape and under the energetic work of the troops were becoming more orderly. Tents in many cases supplanted the rude shelters of blankets and sheets. Thousands of canvas coverings were being distributed and cots replaced the beds of twigs.

The exodus made no apparent decrease in the size of the great tented cities, but the day brought forth a different spirit. "We will stay until we can find another home," were the words heard everywhere.

The work of local relief was being prosecuted among these, many of whom, with a single stroke of the pen, could produce thousands of dollars, but were left with the few dollars they may have had in their pockets. These practically were no better off than the street laborer, who made his pocketbook his bank; but efforts were being made to arrange a system of banking by which immediate necessities could be supplied.

A meeting of members of the San Francisco Clearing House was called to discuss the financial situation, to consider the future of the banks and to prepare some plan to be submitted to the State Clearing Association, which would meet in a few days. The State Bank Commissioners reported all of the banks of the State in splendid condition, but it was believed that the situation demanded that some unusual action be taken to prevent any distressing disturbance.

The advisability of having the Government pay out money from the San Francisco mint on telegraphic orders was considered. It was decided that it might be advisable to suspend banking in the State until a safe readjustment of monetary matters had been reached.

James D. Phelan, chairman of the Finance Committee, reported that local subscriptions had reached the grand total of $228,250. The money given locally would be applied towards providing shelter other than the tents for the homeless thousands in the parks. Lumber was already coming into the city, and temporary huts were to be built at Golden Gate Park, while many of the buildings, such as the Fairmount Hotel and the Merchants' Exchange, which were gutted, would be fitted up to care for the refugees.

NO FIRES ALLOWED IN HOUSES.

Dinner was provided in the same manner as breakfast, no fires being allowed in houses, and many of those who were on the verge of illness recovered from their experiences. On the other hand, the nervous reaction following the heartrending experiences and horrible scenes of the past few days began to tell. Men and women who apparently became normal and filled with hope in the morning, as the day wore off and the terror went with the incoming of the relief, grew hysterical. The constant suspense over missing friends and relatives, coupled with the suddenly restored physical vigor, was causing illness and in some cases insanity.

Several men suddenly went mad during the day and ran amuck. One attempted to kill his wife with a cleaver and had to be arrested to prevent him injuring himself or his family. This was a situation of which the authorities were fearful, and many cases of madness were looked for.

The authorities had been endeavoring, with but little success, to obtain a list of the survivors, so that friends and families might be reunited. In one of the parks a great sign board was built and this was covered with names to direct searchers. In front of this and about the tents where the registration lists were being compiled were anxious crowds. Many families were able to keep together throughout the disaster, but others were scattered. Father sought daughter and mother, son. Husband and wife knew nothing of each other's whereabouts and were frantic with grief and fear.

Cases of this kind became more noticeable. Heretofore, every man was for himself. Appalled at the destruction which had swept away his all and his nerves deadened by hunger and the fearful sights about him, he had either worked furiously in the battle with the flames or sat gazing dully on the ruins about him. Water was his one desire. Food was his craving. But with the relief, with his bodily wants satisfied, friendship and love were again predominating, and the thought of property loss was overshadowed in the greater loss of friends and loved ones.

SURVIVORS TOO DAZED TO RELATE EXPERIENCES.

The crowds were not yet even awakened from the animal-like stupor into which they had fallen, and the next two days promised to bring scenes of grief such as were not even witnessed during the time of fright. The survivors were unable to tell of their experiences. Individual cases were overshadowed in their minds by the greater general catastrophe. "We couldn't get any water," they said, but the terrible sufferings which were experienced were too fearful to be put into words.

James D. Phelan, former Mayor of San Francisco and chairman of the Finance Relief Committee, said:

"When I was awakened in my house by the shock I made my way down town toward the fire, which was raging in two directions. One branch of the fire destroyed my office building on Market Street and the

other my home in the Mission. Of my personal effects I saved but a few. My family left my home and went to Golden Gate Park, where I followed and pitched two tents which I had at my home. Later I accompanied my family to Burlingame, twenty miles south, in an automobile. The city will be rebuilt on lines of strength and architectural beauty heretofore unknown."

Rudolph Spreckels, the sugar magnate, said:

"I can give no connected account of my experiences now. I have not had time to think about myself. I volunteered as a special officer and assisted the firemen in trying to check the fire, and my experience at Van Ness Avenue and Union Street was certainly a thrilling one. Of course, San Francisco will be rebuilt, and better than ever."

HERMAN OELRICHS EXHAUSTED.

Herman Oelrichs, the New York and San Francisco millionaire and society man, who married a daughter of Senator Fair, was thin and haggard. "I was in the St. Francis Hotel," he said, disjointedly. "I lost all my personal effects except the suit of clothes that I have on and two flannel shirts. I have done what I could everywhere to relieve the suffering, and just at present am too exhausted to think connectedly." All of the prominent men of the city told similar stories. All were thoroughly worn out with their heroic efforts in behalf of the city.

General Funston appeared to the people in a light which will make his name ring for generations. From the instant he assumed control Wednesday morning, confronted by the wild panic which pervaded the city, until the danger of famine and fire was supplanted by the dangers of disease, the soldier stuck to his post. His aides asserted that he had not slept since he appeared on the scene. His face was thin and worn, but his eyes were still steady and his commands were issued in the same cool, decisive tone which characterizes the man.

And leaving the fire to other hands, he turned his attention to the distribution of supplies and the prevention of the disease which was now the greatest terror. With him was Mayor Schmitz. Like General Funston, the Mayor, driven by the flames from one office to another, remained at his desk, alert and prepared.

Some little confusion occurred on account of the headquarters of the two men being in different portions of the city, and several orders were conflicting. For a time it was proposed to wire the President asking him to declare General Funston in complete command, but the moment the misunderstanding occurred the General and the Mayor co-operated in the establishment of the military district with the military headquarters at Park lodge.

Engineer, sanitary and Signal Corps officers were detailed and took up the work of providing sanitary conditions and preventing the spread of disease. Major McIver was now laying out a sanitary camp in Golden Gate Park and the soldiers were providing temporary sewerage facilities.

ALL HOSPITALS WERE FILLED.

All of the hospitals were filled, and at the General Hospital, in the Presidio, 700 patients were cared for. Out of this number only seven deaths occurred during the day, while at the Children's Hospital, in California Street, where a large number of injured and ill were treated, only one death occurred.

It was difficult to estimate the number of dead, as bodies were scattered all over the city. They were being buried by gangs of men impressed by the soldiers. In three days thirty-two Chinese and whites were buried in Portsmouth Square alone. Few of the bodies were identified, most of them being burned beyond recognition.

Mayor Schmitz issued the following proclamation, which citizens were instructed to observe:

"Do not be afraid of famine. There will be abundance of food supplied. Do not use any water except for drinking and cooking purposes. Do not light any fires in houses, stoves or fireplace. Do not use any house closets under any circumstances, but dig earth closets in yards or vacant lots, using, if possible, chloride of lime or some other disinfectant. This is of the greatest importance, and the water supply is only sufficient for drinking and cooking. Do not allow any garbage to remain on the premises; bury it and cover immediately. Pestilence can only be avoided by complying with these regulations.

"You are particularly requested not to enter any business house or

dwelling except your own, as you may be mistaken for one of the looters and shot on sight, as the orders are not to arrest, but shoot down anyone caught stealing."

The water supply was to be increased just as fast as pipes could be repaired. In some places railway tracks had been torn up to facilitate the repairing of water mains. Lake Merced was supplying about 1,000,000 gallons to Lakeview Post Office and 7,000,000 gallons to San Francisco. There was water enough stored to supply 35,000,000 gallons a day, the amount formerly used.

Carpenters and masons began at once to repair every bakery left standing in the city in order that they might provide bread for the homeless. The authorities issued an urgent appeal for a supply of chloride of lime, necessary to insure sanitary conditions. It was wanted immediately and in large quantities. Other drugs needed were sulphur, carbolic acid, bichloride of mercury, vaccine points, general antiseptics, formaldehyde, cathartics, castor oil, opium pills, morphine tablets and quinine. It was almost as urgent that people outside the city furnish these drugs at once as it was that they send food.

The authorities had large forces of men at work on the sewer system inside the city all day, and the gangs were being worked at night. Soldiers were seeing that all of the orders in the Mayor's proclamation were being enforced, and, although little force was now needed to obtain compliance with their demands, a strict guard was being kept everywhere.

PEOPLE UNITE IN PRAISE OF REGULARS.

The people were unable to praise sufficiently the regulars who guarded them, utterly oblivious to the terrors of the frightened inhabitants. From the instant the fighting men from the Presidio swung into the city Wednesday morning there was no trifling with their commands. Orders were issued that all looters should be shot without question. That these would be carried out to the letter was not expected by the criminal element of the city, and they hailed the fire with fiendish glee as an opportunity to rob and steal.

Before the first morning had passed, however, thieves had been caught looting the forsaken buildings which the flames were approaching, and the

soldiers, who were on the front of the fire line day and night, without further ado shot them down and left their bodies to be consumed by the blaze.

A son of T. P. Riordan, a real estate dealer, was shot and instantly killed a few feet from his residence. Young Riordan was on his way home and had a bottle of whiskey in his coat pocket. The soldier on duty odered him to stop and throw the whiskey away, and when Riordan refused the soldier immediately shot him dead. A workman employed at the Gerson tannery was on his way home when halted by a sentry. The workman explained that his wife was dying and tried to pass. The sentry shot at him, but missed, and the workman ran back to the tannery.

INSULTER SHOT DOWN.

Women were protected at the point of the gun, and a man at one of the camps was shot down for insulting a girl. There were persistent reports of the hanging of two men in Jefferson Square and the killing of two Japanese by soldiers in the Western Addition. On the other hand, a number of men were arrested on General Funston's order under civil process. Many of these were charged with felony, and, as there was no commitment for them, they could not be received at San Quentin Prison, and were distributed among various police district stations.

No matter whether it was in handling stores or guarding property, the regular reigned supreme, and the people were just beginning to realize how much they owed the men from the Presidio. Without them riot would have broken loose and the liquor-maddened men would have ruled the city. As it was, alcohol was confiscated and the vicious element of the city kept strictly within bounds. In striking contrast to the coolness and efficiency of the men of the army was the force of militiamen and special policemen. The University of California cadets and the men who were unaccustomed to handling weapons and coping with emergencies caused great dissatisfaction, and Chief of Police Dinan recommended to General Funston that they be withdrawn from the city.

Many of these were as panic-stricken as the people they were to protect, and a number of men on the water front were shot for refusing to help in fighting the fire. One man, a foreigner, not understanding

English, started to walk away when a militiaman ordered him to chop some wood. Without more ado, the guard raised his rifle and fired, injuring the other fatally. Such cases as these were numerous. All but the regulars were wrought up to a high pitch of excitement and shot where milder orders would have sufficed.

Martial law was much less rigorously enforced, however, as the appearance of supplies quieted the people, and although conditions would be generally considered fearful, there was a vast improvement over the last night. For the first time in four days the 200,000, bereft of all, weary, torn by ceaseless vigil and the ravages of hunger, slept peacefully, and at midnight in the camps all was silent. Only the sentry, alert still, paced up and down the silent rows of tents wherein lay a people who suffered agonies in a measure that makes men shudder.

And Sunday dawned on a fallen city, but a city with life and hope and energy. Praise for the sparing of their lives was offered, though the elements had almost conquered them, and services were held in all the camps.

SERVICES IN OPEN AIR.

The ministers at a hastily called meeting decided upon this step, and a motley congregation worshiped beneath the skies on the coast of the vast Pacific while the ruined churches in the city still smouldered. It was estimated by ecclesiastical authorities that the loss to churches would not be less than $10,000,000. Bodies to suffer most severely are the Roman Catholic, the Presbyterian, the Congregational, the Baptist, the Episcopal, the Lutheran, the Methodist and the Disciples of Christ.

The leading business men of the city, instead of being disheartened by the calamity, were prone to look into the future, and pessimism was an absent quality. Homer S. King, president of the San Francisco Clearing House, said:

"San Francisco has a future and will rebuild. There is not even a panic, and I have seen more than one panic. It is only a setback, from which the city is strong and vigorous enough to recover. I do not believe any of the bankers consider this disaster anything more than a serious wound, that will heal quickly and cleanly.

"The banks are more than willing to help the people who have shared in the common distress. Chicago and Baltimore recovered from even greater setbacks. The people of San Francisco have always been progressive, and are recognized as hard workers. There is no reason why they should not do the same. The bankers will help build the city. We are absolutely satisfied and assured as to our own standing. Most of the money that is put into circulation will go where it will be most effective in the re-establishment of business."

The cleaning up of the city commenced. Forty bodies were taken from the ruins of a building at 119 Fifth Street by the Red Cross service. The structure, which was a four-story wooden building, containing three flats of ten rooms each, collapsed during the earthquake Wednesday morning. At the time several persons were taken out alive from the upper stories, and it was thought that all the inmates had escaped. The ruins took fire and were consumed. The bodies of those imprisoned within the ruins were burned, only bones being left.

FERRY FIRE CHECKED.

The fire on the water front north of the ferry was under control at 8.30 A. M. It burned as far south as the Lombard Street dock, where it was checked and was now smouldering. The ferry depot and some of the docks in that vicinity were safe.

At night the flames came from Nob Hill ridge, making their way to the big sea wall sheds, docks and warehouses, but reports of damage were conflicting. One statement was that most of the valuable property on the extreme shore line escaped. A *Bulletin* reporter, who had skirted the front in a tug, said that everything except four docks had been swept clean from Fisherman's Wharf, at the foot of Powell Street, to a point around Westerly, almost to the ferry building. This meant that nearly a mile of grain sheds, docks and wharves had been added to the general destruction. The reporter also declared that he saw fire blazing in South San Francisco, and that spots in the suburb were smouldering. According to his account the fire was still burning at the foot of Powell Street, but there was no possibility of it going into the Presidio District.

In the section north of Market Street the ruined district was prac-

tically bounded on the west by the Van Ness Avenue, although in many blocks the flames destroyed squares to the west of that thoroughfare. The Van Ness Avenue burned line runs northerly to Greenwich Street, which is a few blocks from the bay. Then the boundary went up over Telegraph Hill and down to that portion of the shore that faces Oakland.

Practically everything in the district bounded by Market Street, Van Ness Avenue, Greenwich Street and the bay was in ashes. On the east of Hyde Street Hill the fire burned down to Bay Street and Montgomery Avenue and stopped at that intersection. All south of Market Street, with perhaps some exceptions in the vicinity of the Public Mail dock, was gone. This section is bounded on the north by Market Street, and runs to Guererro, goes out that street two blocks, turns west to Dolores, runs west six blocks to about Twenty-second, taking in four blocks on the other side of Dolores. The fire then took an irregular course southward, spreading out as far as Twenty-fifth Street, and going down that way to the southerly bay shore.

CANNOT ESTIMATE DAMAGE.

Rolla V. Watt, manager of the Royal and Queen Insurance Companies and one of the most prominent insurance men on the coast, was asked if he would hazard an estimate of the financial loss. He said: "My idea is something like $200,000,000. I have heard other insurance men place the figure at five hundred millions. We don't know. It is simply too big for any human head to figure out at this time."

An important meeting of the San Francisco Fire Underwriters was held at what will now be its permanent headquarters, Reed's Hall, at Twelfth and Harrison Streets, in Oakland. The sense of the meeting was that the impression should not be given out that the insurance companies had money to throw away and that any losses would be paid until they had been properly adjusted and only such losses as the companies are responsible for would be paid.

This matter was brought to the attention of the board by Mr. Watt. He said: "I met ex-Mayor Phelan on the street yesterday and he asked me to get some sort of a notice given out to the public that their losses would be paid. I do not believe that this is the proper thing, and I told

him so. The companies I represent will pay what they are liable for and no more, and it is better for those whose spirits are drooping to allow them to droop rather than to buoy them up with false hopes."

From the remark made there was no doubt that the companies would draw a fine distinction between the loss by earthquake and that by fire, and would only pay for that which was actually burned. The question of property devastated by dynamite was not touched upon, and will probably be the cause of endless litigation. The records in the Hall of Records were unharmed, which will prevent any tangle in titles.

FUNSTON TELLS OF CONDITIONS.

General Funston sent the following dispatch regarding conditions at San Francisco to the War Department:

"Fire is making no progress to the west from Van Ness Avenue. West wind of considerable force now beginning. Indications now that all that part of the city east of Van Ness Avenue and north to the bay will be destroyed. Some considerable apprehension is felt as to the post of Fort Mason, but it is believed that we can save it. Weather continues fine and warm; practically no suffering from cold. It will be impossible to at once establish proper sanitary conditions. Much sickness must necessarily be expected. If the city to the west now standing remains intact there are many good buildings that can be used as hospitals. The water supply is encouraging. The Spring Valley water people believe they can deliver from ten to twelve million gallons daily. This, with other sources not mentioned, will prevent a water famine."

The San Francisco daily newspapers, all of which were burned out, were gradually getting in shape to serve subscribers. On Thursday morning the best showing the morning journals could make was a small combination sheet bearing the heading "Call-Chronicle-Examiner." It was set up and printed in the office of the Oakland *Tribune,* gave a brief account of the great disaster and took an optimistic view of the future of the stricken city. The papers, though still printed in Oakland, appeared under their own headings and with a few illustrations showing scenes in the streets of San Francisco. It was expected that within a short time they would be able to replace their plants and present their former appearance.

CHAPTER X.

HOMELESS REFUGEES RELATE TALES OF AGONIZING HORROR.

IN writing from Oakland, under date of April 21st, our fair correspondent gives the following graphic story of the dreadful suffering among women and children:

"May God be merciful to the women and children in this land of desolation and despair! Men have done, are doing, such deeds of sublime self-sacrifice, of magnificent heroism, that deserve to make the title of American manhood immortal in the pages of history. The rest lies with the Almighty.

"I spent all of last night and to-day in that horror city across the bay. I went from this city of plenty, blooming with abounding health, thronged with happy mothers and joyous children, and spent hours among the blackened ruins and out on the windswept slopes of the sand hills by the sea, and I heard the voice of Rachel weeping for her children in the wilderness and mourning because she found them not.

"I climbed to the top of Strawberry Hill, in Golden Gate Park, and saw a woman, half naked, almost starving, her hair disheveled and an unnatural lustre in her eyes, her gaze fixed upon the waters in the distance, and her voice repeating over and over again: 'Here I am, my pretties; come here, come here.' I took her by the hand and led her down to the grass at the foot of the hill. A man—her husband—received her from me and wept as he said: 'She is calling our three little children. She thinks the sound of the ocean waves is the voices of our lost darlings.'

"Ever since they became separated from their children in that first terrific onrush of the multitude when the fire swept along Mission Street, these two had been tramping over the hills and parks without food or rest, searching for their little ones. To all whom they have met they have addressed the same pitiful question: 'Have you seen anything of our lost babies?' They will not know what has become of them until order has

been brought out of chaos; until the registration headquarters of the military authorities has secured the names of all who are among the straggling wanderers around the camps of the homeless. Perhaps then it will be found that these children are lying in a trench among the corpses of the weaklings who have succumbed to the frightful rigors of the last three days. Last night a soldier seized me by the arm and cried: 'If you are a woman with a woman's heart, go in there and do whatever you can.'

" 'In there' meant behind a barricade of brush, covered with a blanket, that had been hastily thrown together to form a rude shelter. I went in and saw one of my own sex lying on the bare grass naked, her clothing, torn to shreds, scattered over the green beside her. She was moaning pitifully, and it needed no words to tell a woman what the matter was. I bade my man escort find a doctor, or at least send more women at once. He ran off and soon two sympathetic ladies hastened into the shelter. In an hour my escort returned with a young medical student. Under the best ministrations we could find, a new life was ushered into this hell, which, a few hours ago, was the fairest among cities.

TWO THOUSAND BABIES BORN IN STRICKEN CITY.

" 'There have been at least two thousand such cases,' said the medical student. 'Many of the mothers have died—few of the babies have lived. I, personally, know of nine babies that have been born in the park to-day. There must have been many others here, among the sand hills, and at the Presidio.' Think of it, you happy women who have become mothers in comfortable homes, attended with every care that loving hands can bestow. Think of the dreadful plight of these poor members of your sex. The very thought of it is enough to make the hearts of women burst with pity.

"To-day I walked among the people crowded on the Panhandle. Opposite the Lyon Street entrance, on the north side, I saw a young woman sitting tailor-fashion in the roadway, which, in happier days, was the carriage boulevard. She held a dishpan and was looking at her reflection in the polished bottom, while another girl was arranging her hair. I recognized a young wife, whose marriage to a prominent young lawyer eight months ago was a gala event among that little handful of people who clung to the old-time fashionable district of Valencia Street,

like the Pheland and Dent families, and refused to move from that aristocratic section when the new-made millionaires began to build their palaces on Nob Hill and Pacific Heights. I spoke to the young woman about the disadvantages of making her toilet under such untoward circumstances.

" 'Ah, Julia, dear, you must stay to luncheon,' she said, extending her fingers, just as though she stood in her own drawing room.

I looked at the maid in astonishment, for I had never met the young society woman before. The maid shook her head and whispered when she got a chance:

" 'My mistress is not in her right mind.'

" 'Where is her husband?' I asked.

MIND DERANGED BY SUFFERING.

" 'He has gone to try to get some food,' said the girl. 'She imagines that she is in her own home, before her dressing table, and is having me do up her hair against some of her friends dropping in.'

" 'She must have suffered,' I said, 'to cause such a mental derangement.'

"The girl's eyes filled with tears. She told me that her mistress had seen her brother killed by falling timbers while they were hurrying to a place of safety. A little further on I saw two women concealed as best they might be behind a tuft of sand brush, one lying face down on the ground, while the other vigorously massaged her bare back. I asked if I might help, and learned that the ministering angel was the unmarried daughter of one of the city's richest merchants, and that the girl whom she succored had been employed as a servant in her father's household. The girl's back had been injured by a fall, and her mistress's fair hands were trying to make her well again.

"Thus has this overwhelming common woe leveled all barriers of caste and placed the suffering multitude on a basis of democracy. On a rock behind a manzanita bush near the edge of Stow Lake I saw a Chinaman making a pile of broken twigs in the early morning. The man felt inside his blouse and swore a gibbering, unintelligible Asiatic oath as his hand came forth empty. Observing my escort, the Chinaman approached and said:

" 'Bosse, alle same, catchee match?'

"My escort gave him the desired article, and the Chinaman made a fire of his pile of twigs. 'Why are you making a fire, John?' I asked.

" 'Bleakfast,' he replied, laconically.

SOCIETY FOLKS COMPELLED TO CAMP.

"I asked him where his food might be, and he gave us a quick glance of suspicion as he said briefly, 'No sabbe.' We stood by watching him, evidently to his great distress, and finally he made bold to say, 'You no stand lound, bosse; you go 'way.'

"We left him, but after making the tour around the lake came back to the same place. There sat four people on the ground eating fried pork, potatoes and Chinese cakes. In a young woman of the group I recognized one whom I had seen dancing at one of Mr. Greenway's Friday Night Cotillon balls in the Palace Hotel's maple room during the winter. They offered to share their meal with us, but we told them that we had just come from breakfast in Oakland. I told them about the strange conduct of their Chinaman, who was traveling back and forth from his fire to the 'table' with the food as it became ready to serve. The father of the family laughed.

" 'Yes,' he said, 'that is Charlie's way. He has been with us many years, and when our home was destroyed he came out here with us in preference to seeking refuge among his countrymen in Chinatown. Yesterday we were without food, and Charlie disappeared. I thought he had deserted us, but toward dark he came back with a bamboo pole over his shoulder and a Chinese market gardener's basket suspended from either end. In one of the baskets he had a pile of blankets and a lot of canvas. In the other was an assortment of pork, flour, Chinese cakes and vegetables, besides a half-dozen chickens and a couple of bagfuls of rice.

"Charlie had been foraging in Chinatown for us before the fire reached that quarter. He made a tent and improvised beds for us, and he has the food concealed somewhere in the vicinity, but where he will not tell us, for fear that we will give some of it to others and reduce our own supply. Charlie boils rice for himself. He will not touch the other food. Without him we should have been starving."

"The straits to which the people have been driven to find shelter for the sick may be realized when it is known that a bear's cage has been turned into a hospital. This cage was the home of Monarch, the magnificent grizzly bear which W. R. Hearst sent Allen Kelly into the mountains of Ventura to capture twenty years ago, and which Mr. Hearst gave to the city of his birth. The cage is a large circular inclosure of tall iron bars imbedded in masonry in the open air.

"Adjoining it is an annex, which has been the private boudoir of Monarch's mate. The grizzly was driven into the annex, the gate between them closed, and the large cage, covered with canvas, used to house the sick. There is room in it for several dozen persons, and it is filled with women and children victims of typhoid.

"Near the Japanese tea garden I heard a child crying, and presently found a tiny child tied to a tree. A soldier sentry passing told me that the child's mother had been taken away by the doctors, who said she had smallpox. The father had gone away to procure food, and the mother had caused the doctor to tie her child to the tree so that its father might find it when he returned, and to the little one's dress was pinned a note informing the father what had become of the mother.

CHILDREN'S PLACE OF REFUGE.

"Around the ruins of the refectory at the children's playground ropes have been stretched to form a large inclosure. This is the lost children's place of refuge. There are more than 2000 helpless, terrified atoms of humanity under guard there. Dozens of women and nurses are inside the inclosure working uncomplainingly to minister to the needs of the probably orphaned children.

"Military sentries patrol outside and put back any of the little ones who scramble under the ropes. There is not a minute in the day that anguished mothers who have lost their children are not wandering around inside the ropes looking eagerly among the 2000 little ones and calling their beloved ones by name. Frequently, but alas! much too infrequently, there is a cry, 'Here I am, mamma!' and a shriek of joy comes from some happy mother's heart.

"I saw to-day a noble example of the faithful nature of a dumb brute

for a beloved human being. A dog of lowly mixed breed ran under the ropes among the children. He tumbled the little things right and left until he came to a boy in skirts, who clasped the dog around the neck, and they lavished caresses upon each other.

"The animal was seized by a soldier, tossed over the ropes and kicked away. In a few minutes he was under the ropes again, and found his little master, but was quickly thrown out as before.

"A third time the faithful dog braved abuse. This time the soldier gave him a cruel cuffing and held him up for another soldier to run him through with his bayonet. An officer prevented the killing of the animal and had the boy taken outside the inclosure, where he romped with his pet until he fell asleep, with his head pillowed on the dog's body. Later in the day I learned that the child's father had found him and had taken both the dog and the boy away."

Most thrilling of all stories yet related of adventures in stricken San Francisco during the days of horror and nights of terror is that of a party of four, two women and two men, who arrived in Los Angeles, after having spent a night and the greater portion of two days on the hills about Golden Gate Park.

All were guests at the Palace the night of the 17th. They returned with feet swollen and bruised from miles of walking over ragged, broken streets and with flesh seared and blistered from cinder and flame. The women hastened to a local hotel, where they remained all the afternoon and evening, prostrated from the shock and exposure and denying themselves even to all friends.

FRIGHTFUL CREAKING AND ROARING.

Dr. Ernest W. Fleming, one of the party, told of his adventures as follows:

"I was stopping in a room on the third floor of the hotel when the first shock occurred. An earthquake in San Francisco was no new sensation to me. I was there in 1868, when a boy ten years old, when the first great earthquake came. But that was a gentle rocking of a cradle to the one of Wednesday.

"I awoke to the groaning of timbers, the grinding, creaking sound;

then came the roaring. Plastering and wall decorations fell. The sensation was as though the buildings were stretching and writhing like a snake. The darkness was intense. Shrieks of women, higher, shriller than that of the creaking timbers, cut the air. I tumbled from the bed and crawled, scrambling toward the door. The twisting and writhing appeared to increase. The air was oppressive. I seemed to be saying to myself, 'Will it never, never stop?' When I wrenched the lock, the door of the room swung back against my shoulder. Just then the building seemed to breathe, stagger and right itself.

"But I fled from that building as from a falling wall. I could not believe that it could endure such a shock and still stand. The next I remember I was standing in the street, laughing at the unholy appearance of half a hundred men clad in pajamas—and less.

HUMOR EVEN AMID DESOLATION.

'The women were in their night robes; they made a better appearance than the men. The street was a rainbow of colors in the early morning light. There was raiment of every hue—and in many cases raiment never intended to be seen outside the boudoir. I looked at a man at my side; he was laughing at me. Then for the first time I became aware that I was in pajamas myself. I turned and fled back to my room. There I dressed, packed my grip and hastened back to the street.

"All the big buildings on Market Street toward the ferry were standing, but I marked four separate fires. The fronts of the small buildings had fallen out into the streets and at some places the debris had broken through the sidewalk into cellars. I noticed two women near me. They were apparently without escort. One said to the other: 'What wouldn't I give to be back in Los Angeles again!' That awakened a kindred feeling and I proffered my assistance. I put my overcoat on the stone steps of a building and told them to sit there. In less than two minutes those steps appeared to pitch everything forward, to be flying at me.

"But I was just stunned. I stood there in the street with debris falling about me. It seemed the natural thing for the tops of buildings to careen over and for fronts to fall out. I do not even recall that the women screamed.

"The street gave a convulsive shudder and the buildings somehow righted themselves again. I thought they had crashed together above my head. The two women arose and started to walk. I followed in a kind of aimless sort of way. The street was filled with moving things again. The rainbow raiment had disappeared, and all were clad in street clothes. Every one was walking, but there was no confusion.. We did not even seem in a hurry. Down Market Street the flames were growing brighter.

"We walked with our luggage to the St. Francis. Fires were burning down toward the ferry, but the Fire Department had turned it. We had faith in the Fire Department. Soon I became aware that squads of soldiers were patrolling the streets. It appeared perfectly natural. I do not think I wondered why they were there.

"Men and women were all about us. We looked at each other and talked; even tried lamely to joke. But every few minutes a convulsive quiver swept through the city. The others seemed to be shivering. I noticed that the eyes of the men and women were rolling restlessly. Their tones were pitched high. It seemed to grate on my nerves. Then I fell to wondering whether I was talking shrilly, too.

"HERE, SHOOT THIS MAN!"

"I went to a grocery without a front and bought a few supplies—things that would make a cold lunch. The grocer did not even overcharge me. He was particular to give me the right change. The soldiers came and told us to move on. It seemed the natural thing to do. By this time the fire was creeping dangerously close. We would have walked to the ferry. We tried it on a score of streets, but that wall of fire was always there. It seemed to creep across in front of us.

"And in front of the fire always walked the soldiers. A number of times I hired express wagons. We would ride for a few blocks and get out on the sidewalk. In not a single instance were we charged more than a reasonable price for the ride. Once we loitered until the soldiers came up. A rough fellow, who had been standing by my side, tried to dart through the line. He looked like a beach comber. A young lieutenant caught him by the coat. 'Here,' he called to his men. 'Shoot this man!' I hurried on, without looking back. I don't remember that I heard a shot fired

But at the time it seemed so trivial a matter that I did not pay much attention.

"The air was filled with the roar of explosions. Firemen, soldiers and citizens were dynamiting great blocks. Sailors were training guns to rake rows of residences. All the while we were moving onward with the crowd. Cinders were falling about us. At times our clothing caught fire—just little embers that smoked once and went out. The stinging cinders burned our faces and we used our handkerchiefs for veils.

CLOTHING AFIRE; FACES BURNED.

"Everybody around us was using some kind of cloth to shield their eyes. It looked curious to see expressmen and teamsters wearing those veils. Quite naturally we seemed to come to Golden Gate Park. It seemed as though we had started for there. By this time the darkness was setting. But it was a weird twilight. The glare from the burning city threw a kind of red flame and shadow about us. It seemed uncanny; the figures about us moved like ghosts.

"The wind and fog blew chill from the ocean, and we walked about to keep warm. Thousands were walking about, too; but there was no disturbance. Families trudged along there. There was no hurry. All appeared to have time to spare. The streets, walks and lawns were wiggling with little parties, one or two families in each. All night we moved about the hills. Thousands were moving with us. As the night wore on the crowd grew. Near daylight the soldiers came to the park. They were still moving in front of the fire.

"I had bought a little store of provisions before nightfall. I walked over to the fire made by one squad of soldiers and picked up a tin bucket. I went to a faucet and turned it on. A little water was there. I boiled some eggs and we ate our breakfast. Then we concluded to make our way to the water front, as soldiers were driving us from that part of the hills. The flames were still after us. We walked toward the water front for hours. Part of the time it was through the burned district. The streets were rough, the sidewalks jagged and broken. The women suffered severely. Jagged stones and wires cut their thin shoes from their feet. Bandages did no good.

"The walk back through the ruins was the worst of all. Dead horses lay along our path. Some were burned to a crisp. On Howard Street, near Market, lay the charred bodies of two men. Those were the only dead we saw in the streets. Walking and resting, we reached the ferry near sunset. Soldiers seemed to be everywhere. They were offering milk to women and children. We took a boat to Oakland and hastened by train to Los Angeles. If it were not from the sting of the cinders that still stick to my face I might think it was all a nightmare."

THIEVES HANGED BY CIVILIANS.

Oliver Posey, Jr., said: "Were it not for the fact that the soldiers in charge of the city do not hesitate in shooting down the ghouls the lawless element would predominate. Not alone do the soldiers execute the law. On Wednesday afternoon, in front of the Palace Hotel, a crowd of workers in the ruins discovered a miscreant in the act of robbing a corpse of its jewels. Without delay he was seized, a rope was obtained and he was strung up to a beam which was left standing in the ruined entrance of the Palace Hotel.

"No sooner had he been hoisted up and a hitch taken in the rope than one of his fellow-criminals was captured. Stopping only to obtain a few yards of hemp, a knot was quickly tied and the wretch was soon adorning the hotel entrance by the side of the other dastard. These were only two instances of law executed by civilians that I personally witnessed, but I heard of many more seen by others. The soldiers do all they can, and while the unspeakable crime of robbing the dead is undoubtedly being practiced, it would be many times as prevalent were it not for constant vigilance on all sides as well as the summary justice."

Jack Spencer had much to say of the treatment of those caught in the act of rifling the dead of their jewels.

"At the corner of Market and Third Streets on Wednesday," said Mr. Spencer, "I saw a man attempting to cut the fingers from the hand of a dead woman in order to secure the rings which adorned the stiffened fingers. Three soldiers witnessed the deed at the same time and ordered the man to throw up his hands. Instead of obeying the command he drew a revolver from his pocket and began to fire at his pursuer without warning.

The three soldiers, reinforced by half a dozen uniformed patrolmen, raised their rifles to their shoulders and fired. With the first shots the man fell, and when the soldiers went to the body to dump it into an alley eleven bullets were found to have entered it."

Miss Bessie Tannehill, of the Tivoli Theatre, San Francisco, in referring to her experience, said:

"I was asleep in the Hotel Langman, Ellis and Mason Streets, when the shock came. There were at least 100 persons in the building. At the first shock I leaped from my bed and ran to the window. Another upheaval came and I was thrown from my feet. I groped my way out of the room and down the dark stairway. Men, women and children, almost without clothing, crowded the halls, crying and praying as they rushed out. We finally obtained a carriage by paying $100. Fire was raging at this time and people were panic-stricken.

"After getting outside of the danger region I walked back, hoping to aid some of the unfortunates. The merchants on upper Market and nearby streets threw open their stores and invited the crowds to help themselves. Mobs rushed into every place, carrying out all the goods possible. I saw many looters and pickpockets at work. On Mason Street a gang of thieves was at work. They were pursued by troops, but escaped in an automobile."

GREAT HEAT FELT FOR A MILE.

"The steamship 'Itauri' left San Francisco Thursday afternoon, when the flames seemed to be at their height," said First Mate Charles Appen. "As seen from the bay it was a sublime but terrible spectacle. We were anchored more than a mile out in the roadstead, but the wind as it swept over the burning city and down upon us was like the breath of a demon. At times it was impossible for us to remain on deck so great was the heat. The terrific concussions of dynamite brought hundreds of fish to the surface. Our clearance papers were burned, but we could not retain our anchorage and late Thursday afternoon we started toward the open sea.

"Wharves were filled with people. They beckoned to us that they needed assistance. It was the thought of self-preservation that kept the 'Itauri's' course unchanged. At midnight we were thirty miles at sea, but the flames

were still visible and until almost dawn we stood on deck and watched the reflection of the flames as they played to and fro on the cloud mountains which hung over the ruined city."

Twenty-two members of the Metropolitan Opera Company, of New York, victims of the San Francisco disaster, passed through Ogden, Utah, April 21st.

Mme. Sembrich said that her loss was about $40,000. She was fortunate in recovering her pearls, which were with her in the apartment at St. Francis Hotel. She said:

"I am only too glad to be out with my life. I was stopping on the sixth floor of the hotel, and was asleep when the first shock was felt. I jumped out of bed, and ran into the street with nothing but my night robe. After remaining for an hour on the square opposite the hotel I returned to the aprtment and dressed. It was at this time that I brought my jewels. It was remarkable how the people stayed together. I was taken to the home of Dr. Harry Tavis. He said that he intended remaining with the ladies, even though he lost his all. He was true to the promise, for he witnessed his beautiful home burning and did not leave the ladies for a moment. It proved to me the spirit of the American people, which is indeed remarkable."

PREPARED TO GIVE MATINEE.

"I stayed at the Opera House until I was convinced it was doomed," said Mr. Goritz. "I was of the opinion that, as the building was fireproof, it would be safe. Fires were at that time all around the building. I lost all my personal effects, escaping with nothing but the clothes which I have on my back. In the morning and before the fire had reached the Opera House I fully intended to give the proposed matinee performance, 'The Marriage of Figaro.' All of the musicians and myself worked up to the very time we were ordered away in an unavailing effort to save the property."

Conductor Hertz said, in a jocular way:

"I am wearing Caruso's shirt, and am glad to be able to do. I brought a souvenir of the fire," and with these words he showed a key to room 516 of the Palace Hotel.

"I was occupying a room at the Palace Hotel," Signor Caruso said, "and was awakened about 5.10 by the first shock. The elegant big hotel danced a jig for several minutes and then returned to its natural position. This is one of the signs which I cannot understand, and I suppose never will. After the structure had regained its natural position, I hurriedly ran to the street. It is a miracle that some of us were not killed, as the debris in a very short space of time had the thoroughfares blocked. The big steel scrapers were toppling, and I could see eight or nine afire from where I was standing."

Mr. Dippel said that his loss would probably reach $25,000. Miss Abbott said that she had apartments on the top floor of the Palace Hotel. When the shock came she rushed to the streets, to find them crowded with people rushing backward and forward frantically. An attempt was made to get expressmen to remove trunks, but was unsuccessful. Miss Abbott praised the people of San Francisco, saying that there was no panic.

EXPERIENCE OF A SURVIVOR.

Adolphus Busch, of St. Louis, told of his experiences in the earthquake and fire. He said:

"I left San Francisco on April 20th with my family, Harry Nickaul and Carl Conrad. The earthquake which shook San Francisco made all frantic and was undoubtedly the severest ever experienced in the United States. The beautiful Hotel St. Francis swayed from south to north like a tall poplar in a storm. Furniture, even pianos, were overturned, and people were thrown from their beds.

"I quickly summoned my family and friends and urged them to escape to Jefferson Square, which we promptly did. An awful sight met our eyes. Every building was either partly or wholly wrecked, roofs and cornices were falling from skyscrapers on lower houses, crushing and burying the inmates.

"Fires started in all parts of the city, the main water pipes burst and flooded the streets. One earthquake followed the other. The people became terrified, but all behaved wonderfully calm. More than 200,000 persons were without shelter, camping on the hills. There was no light, water or food. Fortunately the regulars and militia maintained order and

discipline, otherwise more horrors would have occurred and riots might have prevailed.

"The fire spread over three-fourths of the city, and could not be controlled; no water to fight it, no light, and the earth still trembling.

"Building after building was demolished to check the progress of warring, seething flames, but all of no avail. We were fortunate to obtain two conveyances and fled to Nob Hill, from which we witnessed the indescribable drama. Block after block was devastated. The fires blazed like volcanoes and all business houses, hotels, theatres, in fact the entire business portion lay in ruins, and two-thirds of the residences; but I trust that a new and more beautiful San Francisco will be born and that the generous American nation will give it the support and financial assistance it so fully deserves.

"After a night of horrors we boarded the ferry for Oakland, where my private car had been since Tuesday, and started for home, with nothing saved but what is on our backs, but extremely happy at having escaped unharmed."

GIRL SAW DYING MAN SHOT.

"Soldiers shot living beings to save them the tortures of death in the flames," said Miss Margaret Underhill, of Chicago.

"The horror of it all was so overwhelming, the sight of the dead became commonplace. The misery of the living received scarcely passing notice. Seconds seemed like hours, and the two days like twenty years. I was in a three-story frame building. The house seemed to swing like the pendulum of a clock. Plaster was falling about me and pictures fell from the wall as I sprang from my bed.

"At that moment the brick chimney of the Sacred Heart College, adjoining, crashed through the ceiling, burying my bed beneath the debris. A second chimney fell a few feet behind me as I rushed down the hall. After the shock subsided I returned, dressed and with the help of my friends, moved my trunk to the street, where I left it to be devoured by the flames. We stopped to watch the soldiers, firemen and policemen, who, with timbers from the wreckage, were at work on the front of a burning frame building. The front of a three-story structure had fallen outward.

"Pinned beneath the structure was a man who pleaded piteously with the men who worked to release him. His head and shoulders projected from the wreckage. With his free arm he tried to help the workers by pulling at the timbers. One by one the men were driven back by the approaching flames until at last only one, a soldier, remained. His face was blistered by the heat.

" 'Good-by,' the soldier shouted as a sheet of flame swept around the corner of the building. The place was a roaring hell. The soldier picked up his rifle, which was standing against a broken timber and turned to go. From where we stood we could see the very timber that held the man down smoke. His hair and mustache were singed.

BEGGED TO BE SHOT.

" 'For God's sake, shoot me,' he begged. His voice rose clear above the roar of the flames. The soldier turned and went back to within twenty-five feet of the man and said something. Then he started to walk away. 'Shoot me before you go,' the man yelled. The soldier turned quickly. His rifle was at his shoulder. The rifle cracked and the blood spurted from the head of the man.

"I covered my eyes and walked on. I saw mothers seated on the curbstones trying to still the hunger of their babies with beer. As we walked along the water front I saw them digging trenches and burying piles of dead. Garbage wagons served as hearses. Wearied with the day, I slept soundly through the night. My bed was the rocks of North Beach."

The first refugees from San Francisco to reach Chicago arrived April 21st, on the Overland Limited over the Northwestern. There were eight who came through from the scene of destruction, aside from the train crew. Seventy-five advance reservations had been made for passage. Sixty-eight failed to get across the bay to the place where the fast Northwestern train was ready to start Wednesday morning.

Mr. H. N. Hovey, one of the refugees, in describing the first effects of the earthquake shock, said: "My family and I had apartments on the third floor of the Palace Hotel when the city was shaken by the earthquake. It was about 5.15 o'clock when I was suddenly thrown from my bed by the terrible shock.

"With the first shock part of the building crumbled away. In an instant I was up. In an adjoining room my daughters were sleeping. The panic in the hotel was awful. Everywhere persons were running about, evidently crazed or dazed. We managed to reach the street, though our clothes were almost torn from our bodies in the crush when we attempted to leave the building. The scene in Market Street was terrible. Great piles of debris were in the streets, and wherever we turned we could hear the heartrending cries of the victims. Many of the children had fallen, and by that time the fire had begun to eat its way up Market Street. In front of the Palace Hotel great crowds had gathered. As each second passed the scene became more terrible. The fire was working its way up Market Street, and I saw that it would only be a short time before that part of the city would be burning. I finally got a cab, and after making a wide detour of the city, staying out of the fire zone, I reached the Union Ferry Station. Just as we reached the landing a boat left. I chartered a tug and in that way reached Oakland, where we took the Overland Limited."

CHAPTER XI.

CHINATOWN SECRETS LAID BARE BY DISASTER.

NOT until the earthquake shook the rickety houses to the earth to be destroyed by fire did the authorities of San Francisco realize what manner of place was the much advertised Chinatown, the Mecca of all tourists in California, the spot in which 25,000 Chinese lived like so many prairie dogs.

When the high winds which came after the fire blew the ashes away the yawning mouths of tunnels, which the police had long suspected, were revealed. Entrance to these passages was so carefully hidden that only the leaders of the Tonga, who used the damp dungeons for places of meeting or to plot the death of a victim—the same room often acting as the execution dungeon once the marked man was taken below the level of the street—knew and declared.

One of San Francisco's alert detectives, said to be the best posted man on Chinatown, stood at the corner of Bartlett Alley and declared:

"For years I have been trying to reach the tunnels which I knew to exist under this Chinese city. What goes on down there one can only conjecture, but it is a thousand times worse than the sins and vices which are practiced by these Mongolians in the streets and gambling houses you can see from this corner. Girls in the bloom of youth are smuggled over the Canadian border, brought here in the night, and confined in dungeons, perhaps never to look upon the light of the sun again, although they may live for years."

Very few white men have visited the underground passages, certainly none of San Francisco's police force, for every man in the department was watched when he entered Chinatown and the surveillance did not cease while he remained there. Secretary Tsing, a prominent member of the Chinese aristocracy, stationed for political reasons in the Chinese Legation at the capital of Peru, was a member in high standing in a society of considerable political influence in China, with a powerful branch in San

Francisco. He took two white men to the theatre in Chinatown and boastfully declared that the real secret of Chinatown had never been revealed. He conducted the men to the rear of the stage, slid a secret door back and motioned for the men to follow him.

For one hour, stooping until their backs were strained, the men silently followed a guide, to look upon a complete new Chinatown, the tunnel leading past scores of doors to dungeons, against the bars of which some unfortunates pressed their faces, to jump back from the flame of a flickering miner's light which Tsing carried.

Under this Chinese city were hundreds of women and children. Their voices mingled in glad refrain or echoed the gloomy murmurs of some who were suffering. Huddled in groups about a small fire, made from balls of coal dust which Chinese prepare, were merchants who had returned from their shops on the street level to these holes in the wall to plot and invent. The odor of opium was nauseating. The revulsion of feeling was overpowering. When the street was reached, after climbing a flight of stairs to the kitchen of a chop suey "joint," the breath of foul air, even in this hole, was refreshing.

TRAGEDIES UNDERGROUND.

Hundreds of men went to their deaths each year in Chinatown without an inkling of the tragedies being known to the police. It was easy to bury the dead under the tunnels, one hundred feet deep, in Chinatown. Members of tongs marked for death left friends behind, men who refused to complain to the local authorities, but who, instead, sought revenge themselves in the same fiendish manner that death had been meted out to their fellow-members.

For years battles waged. Scores and scores were killed, even in the streets, until the citizens of San Francisco threatened to organize a vigilance committee and wipe Chinatown from the face of 'Frisco. This had its effect. The war was carried below the streets, where dying men could scream in agony and not be heard. The slave traffic has enriched many Chinese, suave merchants who led simple lives above the street, but who retired to the subterranean passages and their slave marts to put upon the block the newest arrivals from the slave market in Canton.

Gambling has always existed here. The gamblers composed the bad element. They fought for one another's gold, committed murder to obtain means with which to enter games of fantan and other Chinese devices of chance, and slept away their daylight hours in a bunk somewhere down below the street, steeped in the fumes of opium, a sordid mass of humanity until nature awoke the brain to life.

There never will be such a Chinatown in San Francisco again. These people will be sent to a district far from the heart of the new city, where they will be under such close surveillance that practices of the past will be stopped when they begin. Provision will be made to suppress the tongs for all time, if this can be accomplished.

No one will ever know how many lives were lost in Chinatown. It is a moral certainty that men overcome with opium, the slave women in their dungeons, and many a hapless wretch unconscious from morphine were killed when the tremor of the earth toppled the buildings down to be consumed in a short time by the fire.

Citizens who have visited the remains of this plague spot were astonished at the catacombs which lay exposed. It is improbable that any attempt will be made to reach the bodies of Chinese victims. Earth will be thrown into the gaping abyss, burying for all time the victims of the disaster and blotting forever the sites of these dens of vice and horrible chambers of sin.

THE OLD TOWN FOREVER GONE.

The old San Francisco is dead. The gayest, lightest-hearted, most pleasure-loving city of this continent, and in many ways the most interesting and romantic, is a horde of huddled refugees living among ruins. It may rebuild; it probably will; but those who have known that peculiar city by the Golden Gate and have caught its flavor of the Arabian Nights feel that it can never be the same. It is as though a pretty, frivolous woman had passed through a great tragedy. She survives, but she is sobered and different. If it rises out of the ashes it must be a modern city, much like other cities and without its old flavor.

The city lay on a series of hills and the lowlands between. These hills are really the end of the Coast Range of mountains which lie between the

interior valleys and the ocean to the south. To its rear was the ocean; but the greater part of the town fronted on two sides on San Francisco Bay, a body of water always tinged with gold from the great washings of the mountain, usually overhung with a haze, and of magnificent color changes. Across the bay to the north lies Mount Tamalpais, about 5,000 feet high, and so close that ferries from the waterfront took one in less than half an hour to the little towns of Sausalito and Belvidere, at its foot.

PECULIAR YET DELIGHTFUL CLIMATE.

The climate of California is peculiar; it is hard to give an impression of it. In the first place, all the forces of nature work on laws of their own in that part of California. There is no thunder or lightning; there is no snow, except a flurry once in five or six years; there are perhaps half a dozen nights in the winter when the thermometer drops low enough so that there is a little film of ice on exposed water in the morning. Neither is there any hot weather. Yet most Easterners remaining in San Francisco for a few days remember that they were always chilly.

For the Gate is a big funnel, drawing in the winds and the mists which cool off the great, hot interior valleys of the San Joaquin and Sacramento. So the west wind blows steadily ten months of the year and almost all the mornings are foggy. This keeps the temperature steady at about 65 degrees—a little cool for comfort of an unacclimated person, especially indoors. Californians, used to it, hardly ever think of making fires in their houses except in the few exceptional days of the winter season, and then they rely mainly upon fireplaces. This is like the custom of the Venetians and the Florentines.

But give an Easterner six months of it, and he, too, learns to exist without a chill in a steady temperature a little lower than that to which he is accustomed at home. After that one goes about with perfect indifference to the temperature. Summer and winter San Francisco women wear light tailor-made clothes, and men wear the same fall weight suits all the year around.

One usually entered the city by way of San Francisco Bay. Across its yellow flood, covered with the fleets from the strange seas of the Pacific, San Francisco presented itself in a hill panorama. Probably no other city

of the world could be so viewed and inspected at first sight. It rose above the passenger, as he reached dockage, in a succession of hill terraces.

At one side was Telegraph Hill, the end of the peninsula, a height so abrupt that it had a 200-foot sheer cliff on its seaward frontage. Further along lay Nob Hill, crowned with the Mark Hopkins mansion, which had the effect of a citadel, and in later years by the great, white Fairmount. Further along was Russian Hill, the highest point. Below was the business district, whose low site caused all the trouble.

Except for the modern buildings, the fruit of the last ten years, the town presented at first sight a disreputable appearance. Most of the buildings were low and of wood. In the middle period of the 70's, when a great part of San Francisco was building, there was some atrocious architecture perpetrated. In that time, too, every one put bow windows on his house, to catch all of the morning sunlight that was coming through the fog, and those little houses, with bow windows and fancy work all down their fronts, were characteristic of the middle class residence districts.

MIXTURE OF ALL RACES.

Then the Italians, who tumbled over Telegraph Hill, had built as they listed and with little regard for streets, and their houses hung crazily on a side hill which was little less than a precipice. For the most part, the Chinese, although they occupied an abandoned business district, had remade the houses Chinese fashion, and the Mexicans and Spaniards had added to their houses those little balconies without which life is not life to a Spaniard.

The hills are steep beyond conception. Where Vallejo Street ran up Russian Hill it progressed for four blocks by regular steps like a flight of stairs. With these hills, with the strangeness of the architecture and with the green gray tinge over everything, the city fell always into vistas and pictures, a setting for the romance which hung over everything, which has always hung over life in San Francisco since the padres came and gathered the Indians about Mission Dolores.

And it was a city of romance and a gateway to adventure. It opened out on the mysterious Pacific, the untamed ocean, and most of China, Japan, the South Sea Islands, Lower California, the west coast of Central

America and Australia that came to this country passed in through the Golden Gate. There was a sprinkling, too, of Alaska and Siberia. From his windows on Russian Hill one saw always something strange and suggestive creeping through the mists of the bay. It would be a South Sea Island brig, bringing in copra, to take out cottons and idols; a Chinese junk with fan-like sails, back from an expedition after sharks' livers; an old whaler, which seemed to drip oil, back from a year of cruising in the Arctic. Even the tramp windjammers were deep-chested craft, capable of rounding the Horn or of circumnavigating the globe; and they came in streaked and picturesque from their long voyaging.

In the orange-colored dawn which always comes through the mists of that bay, the fishing fleet would crawl in under triangular lateen sails, for the fishermen of San Francisco Bay are all Neapolitans, who have brought their costumes and their customs and sail with lateen rigs shaped like the ear of a horse when the wind fills them and stained an organge brown.

IN THE REALM OF CRIME.

Along the waterfront the people of these craft met. "The smelting pot of the races," Stevenson called it; and this was always the city of his soul. There are black Gilbert Islanders, almost indistinguishable from negroes; lighter Kanakas from Hawaii or Samoa; Lascars in turbans; thickset Russian sailors; wild Chinese with unbraided hair; Italian fishermen in tam o' shanters, loud shirts and blue sashes; Greeks, Alaska Indians, little bay Spanish-Americans, together with men of all the European races. These came in and out from among the queer craft, to lose themselves in the disreputable, tumbledown, but always mysterious shanties and small saloons. In the back rooms of these saloons South Sea Island traders and captains, fresh from the lands of romance, whaling masters, people who were trying to get up treasure expeditions, filibusters, Alaskan miners, used to meet and trade adventures.

The Barbary Coast was a loud bit of hell. No one knows who coined the name. The place was simply three blocks of solid dance halls, there for the delight of the sailors of the world. On a fine busy night every door blared loud dance music from orchestra, steam pianos and gramaphones,

and the cumulative effect of the sound which reached the street was at least strange. Almost anything might be happening behind the swinging doors.

For a fine and picturesque bundle of names characteristic of the place, a police story of three or four years ago is typical. Hell broke out in the Eye Wink Dance Hall. The trouble was started by a sailor known as Kanaka Pete, who lived in the What Cheer House, over a woman known as Iodoform Kate. Kanaka Pete chased the man he had marked to the Little Silver Dollar, where he turned and punctured him. The by-product of his gun made some holes in the front of the Eye Wink, which were proudly kept as souvenirs and were probably there until it went out in the fire. This was low life, the lowest of the low.

Until the last decade almost anything except the commonplace and the expected might happen to a man on the water front. The cheerful industry of shanghaiing was reduced to a science. A stranger taking a drink in one of the saloons which hung out over the water might be dropped through the floor into a boat, or he might drink with a stranger and wake in the forecastle of a whaler bound for the Arctic. Such an incident is the basis of Frank Norris' novel "Moran of the Lady Letty," and although the novel draws it pretty strong it is not exaggerated. Ten years ago the police and the foreign consuls, working together, stopped this.

These are a few of the elements which made the city strange and gave it the glamour of romance which has so strongly attracted such men as Stevenson, Frank Norris and Kipling. This lay apart from the regular life of the city, which was distinctive in itself.

THE CALIFORNIAN'S CHARACTERISTICS.

The Californian is the second generation of a picked and mixed stock. The merry, the adventurous, often the desperate, always the brave, deserted the South and New England in 1849 to rush around the Horn or to try the perils of the plains. They found there already grown old in the hands of the Spaniards younger sons of hidalgos and many of them of the proudest blood of Spain. To a great extent the pioneers intermarried with Spanish women; in fact, except for a proud little colony here and there,

the old Spanish blood is sunk in that of the conquering race. Then there was an influx of intellectual French people, largely overlooked in the histories of the early days, and this Latin leaven has had its influence.

Brought up in a bountiful country, where no one really has to work very hard to live, nurtured on adventure, scion of a free and merry stock, the real, native Californian is a distinctive type; as far from the Easterner in psychology as the extreme Southerner is from the Yankee. He is easy-going, witty, hospitable, lovable, inclined to be unmoral rather than immoral in his personal habits, and above all easy to meet and to know.

Above all there is an art sense all through the populace which sets it off from any other part of the country. This sense is almost Latin in its strength, and the Californian owes it to the leaven of Latin blood.

GAY LIFE OF SAN FRANCISCO.

With such a people life was always gay. If they did not show it on the streets, as do the people of Paris, it was because the winds made open cafes disagreeable at all seasons of the year. The gayety went on indoors or out on the hundreds of estates that fringed the city. It was noted for its restaurants. Perhaps the very best for people who care not how they spend their money could not be had there, but for a dollar, 75 cents, 50 cents, a quarter or even 15 cents the restaurants afforded the best fare on earth at the price.

The San Francisco French dinner and the San Francisco free lunch were as the Public Library to Boston or the stockyards to Chicago. A number of causes contributed to this consummation. The country all about produced everything that a cook needs, and that in abundance—the bay was an almost untapped fishing pond, the fruit farms came up to the very edge of the town, and the surrounding country produced in abundance fine meats, all cereals and all vegetables.

But the chefs who came from France in the early days and liked this land of plenty were the head and front of it. They passed on their art to other Frenchmen or to the clever Chinese. Most of the French chefs at the biggest restaurants were born in Canton, China. Later the Italians, learning of this country where good food is appreciated, came and brought their own style. Householders always dined out one or two nights of

the week, and boarding houses were scarce, for the unattached preferred the restaurants. The eating was usually better than the surroundings.

Meals that were marvels were served in tumbledown little hotels. Most famous of all the restaurants was the Poodle Dog. There have been no less than four restaurants of this name, beginning with a frame shanty where, in the early days, a prince of French cooks used to exchange recipes for gold dust. Each succeeding restaurant of the name has moved further downtown; and the recent Poodle Dog stands—or stood—on the edge of the Tenderloin in a modern five-story building.

For on the ground floor was a public restaurant where there was served the best dollar dinner on earth. It ranked with the best and the others were in San Francisco. Here, especially on Sunday night, almost everybody went to vary the monotony of home cooking. Everyone who was anyone in the town could be seen there off and on. It was perfectly respectable. A man might take his wife and daughter there.

On the second floor there were private dining rooms, and to dine there, with one or more of the opposite sex, was risque, but not especially terrible. But the third floor—and the fourth floor—and the fifth! The elevator man of the Poodle Dog, who had held the job for many years, and never spoke unless spoken to, wore diamonds and was a heavy investor in real estate.

There were others as famous in their way—Zinkard's, where, at one time, everyone went after the theatre, and Tate's, which has lately bitten into that trade, the Palace Grill, much like the grills of Eastern hotels, except for the price; Delmonico's, which ran the Poodle Dog neck and neck in its own line, and many others, humbler, but great at the price.

A CITY THAT NEVER SLEPT.

The city never went to bed. There was no closing law, so that the saloons kept open nights and Sundays at their own sweet will. Most of them elected to remain open until 3 o'clock in the morning, at least.

"High society" in San Francisco had settled down from the rather wild spirit of the middle period; it had come to be there a good deal as it is elsewhere. There was much wealth, and the hills of the Western Addition were growing up with fine mansions.

CHAPTER XII.

NARRATIVE OF A VICTIM SURROUNDED BY A FRANTIC MULTITUDE.

EVERY train from the West brought refugees from San Francisco, who gave graphic descriptions of the horrors of the earthquake and fire. Worn by the exposure, hardships and terrors of a two days' effort to escape from the stricken city, Mrs. D. M. Johnson, of Utica, N. Y., and Miss Martha S. Tibbals, of Erie, Pa., passed through Denver on their way home.

"We were awakened in our room at the Randolph Hotel on Wednesday morning by a terrific shaking, which broke loose fragments of the ceiling," said Miss Tibbals. "There followed a tremendous shock, which shook the building sideways and tossed it about with something like a spiral motion. When we reached the street people were running hither and thither. Some persons passing advised us to get on as high ground as possible, and we started walking as fast as possible to the high parks back of the city.

"Fire was breaking out in hundreds of places over the city and the streets were becoming crowded with hurrying refugees. Where they were unable to obtain horses, men and women had harnessed themselves to carriages and were drawing their belongings to places of safety. As we passed through the district where wealthy persons lived we saw automobiles drawn up and loaded before houses. Their owners remained until the flames came too near and then getting into the machines made for the hills.

$2,000 HIRE FOR AN AUTOMOBILE.

"We saw one man pay $2000 for an automobile in which to take his family to a place of safety. Before night we reached the summit of the Alta Plaza. People half clad, unfed, hysterical, searching for loved ones, crowded the ground. Beneath lay the burning city.

"We passed the night sleepless with a panic-stricken multitude. In

the morning (Thursday) we started toward the harbor with the assistance of soldiers from the Presidio, who had already been on duty twenty-four hours. We got to the wharf and hoped to get a launch to Oakland. We were unable to do so, but were kindly treated by an old skipper, who was in deep grief because his mother had been crushed to death in their little house. He gave us coffee—the only nourishment we had excepting a few crackers in twenty-four hours.

"The skipper saw the Government boat coming in the bay, and said if we could reach the Presidio wharf we could escape on the Government boat. We hurried toward the Presidio, greatly impeded by fissures which stretched long distances and around which we had to make our way. At the Presidio we were taken on board with other refugees and a short time later we were safe in Oakland.

CLIMBED OVER BODIES.

"I climbed over bodies, picked my way around flaming debris and went over almost unsurmountable obstacles to get out of San Francisco," said C. C. Kendall, a retired Omaha capitalist. "I arrived in San Francisco the night before the earthquake. I was awakened by being thrown out of my bed in the Palace annex. I rushed to the window and looked out. The houses were reeling and tumbling like playthings. I hurried on clothing and ran into the street. There I saw many dead and the debris was piled up along Market Street.

"I went to the office of the Palace Hotel. Men, women and children were rushing about, crazed and frantic, in their night clothes. The first shock lasted only 28 seconds, but it seemed to me two hours. A few minutes after I reached the Palace Hotel office the second shock came. It was light compared with the first, but it brought to the ground many of the buildings that the first shock had unsettled.

"Fires were breaking out in every direction. Market street had sunk at least four feet. I started for the ferry. It was only a few blocks from the Palace annex to the ferry, but it took me from 6 o'clock until 10.15 to cover the space. Men and women fought about the entrance of the ferry like a band of infuriated animals. I made my escape—I do not remember how, for I was as desperate as any of them. As the boat pulled

over the bay the smoke and flame rose successively high, and the roar of the falling buildings and the cries of the people filled the air.

"The first I remember of the earthquake was finding myself in the middle of the floor where, with chairs and other bits of furniture, I had been thrown," said G. F. Burgner, a business man of Osceola, Wis. With his wife and two daughters he had registered at the St. Francis Hotel in San Francisco the night before the disaster. "With my family I rushed downstairs. We pushed our way through the crowded streets, where every one was hurrying here and there. Some were pulling trunks behind them. Bricks, stone and all sorts of debris filled the roadway, and we had a difficult time in making our way to the water front. An electric launch was moored there, and on it we escaped to Oakland.

"The groans and cries of those held under the timbers of the collapsing buildings were pitiful to hear, and the worst of it was that nothing could be done to save them."

PEOPLE ROLLED DOWN STAIRS.

"The room seemed to twist out of shape," said Mr. Harriman, "and the furniture was disarranged. The door stuck, and it required all my strength to open it. Men were shouting, women screaming hysterically and everybody was endeavoring to get to the elevators and stairways. It was soon discovered that the elevators were not running, and the people fell and rolled down the stairs.

"My wife and I descended, and on the first floor found a mass of people whom the hotel employes were imploring to remain there, as it was the safest place, but all seemed determined to get outside. Dressing as we ran, my wife and I found that we had grabbed up enough clothes to present a respectable appearance, except that we had no shoes. We gradually fought our way to the ferries.

"All along the way we saw bodies of human beings. Some had been crushed by falling walls, others had jumped from high buildings, while still others had been trampled to death by the excited populace. Horses, having broken their hitch reins, were dashing frantically along the streets, knocking people down. We finally got aboard a ferryboat and landed on the other side of the bay. We took the first train for the East."

"I was in a Southern Pacific train twenty miles from San Francisco when the shock came," said Frederick Droege, of the Licking Rolling Mills, Covington, Ky. "Passengers were tumbling out of their berths into the aisle. The conductor stopped the train and looked to see what we had hit. Nobody could find out what it was. Some one suggested an earthquake, and we ridiculed the idea. We went on a few miles, and looking out of the window saw that the chimneys of the houses had fallen over. Further on two great fissures appeared on each side of the track, where the earth had opened. A little further we saw that the Santa Fe track, next to ours, had sunk out of sight where there had been a deep fill. Then we realized that it was an earthquake all right."

AUCTION FOR CHANCE TO FLEE.

Arthur Woodson, of Chicago, who was in the Palace Hotel at the time of the earthquake, said: "After breakfast I hustled around to get over the bay to Oakland. A few hacks were in commission, and a regular auction was being held over the seat sold to each passenger. The prices ranged from $20 to $100. I got a seat in one of the hacks for $35. There were three other men in it that paid $50 for seats. We had to go to the ferry in a roundabout way, and when we had covered several blocks two men hailed the driver. They offered $100 apiece for the privilege of riding to the ferry. The driver took one up on the box with him, handed me my $35 and made me get out so that his $100 passenger could get into his carriage.

"I hailed the next hack that came along and got up on the box beside the driver. Another fellow from the sidewalk called out that he would give $75 to be taken to the ferry, but I told the hack driver that I would throw him off the box if he stopped, as he had no room either inside or out for another passenger."

O. M. Nichols, a New York traveling salesman, fled from the Palace Hotel, leaving a vest behind in which was $200. He paid $30 to ride two blocks to the ferry in an automobile, and was one of a party which paid $250 for a tug to take them to Oakland.

"I shall never forget the scenes at the ferryhouse," Mr. George Musgrove said. "It was bedlam, pandemonium and hell rolled into one. There

must have been 10,000 people trying to get on that boat. Men and women fought like wild cats to push their way aboard. Clothes were torn from the backs of men and women and children indiscriminately. Women fainted, and there was no water at hand with which to revive them. Men lost their reason at those awful momenets. One big, strong man beat his head against one of the iron pillars on the dock, and cried out in a loud voice: 'This fire must be put out! The city must be saved!' It was awful.

THOUGHT END OF WORLD HAD COME.

"When the gates were opened the mad rush began. All were swept aboard in an irresistible tide. We were jammed on the deck like sardines in a box. No one cared. We were out of the smoke-filled atmosphere and were on our way to a place of comparative safety. One peculiar thing is that almost every one thought that the end of the world was at hand. Native sons of San Francisco had experienced earthquakes before. This was something new. It was not an earthquake. It was something worse. They had no communication with the outside world. Naturally, they imagined that the disturbances which were taking place in Frisco were being repeated all over the country. This belief was universal. The freaks of the earthquake were marvelous. Some of the streets were twisted, others showed the effects of the earth waves and were a mass of little depressions and undulations."

Mrs. Jessie Rudisill, of Denver, was in the San Marco Hotel, which was wrecked. She stayed in the hotel Wednesday until 11 A. M. She said:

"When we were told we must leave the hotel we walked and walked. All day we walked and watched the fire. The streets were crowded with people just wandering about and looking at the flames ever leaping higher. We made our way to the St. Francis, only a little way off, on Van Ness avenue. But to reach there it seemed as though we walked miles and miles. They had no room for us at the St. Francis. But we just had to stay there. There was no other place to go.

"Descibe the scene? It was like the burning of Rome as we see it in fireworks. It was the wrath of God for the wickedness of the city—for the hell dives, for underground Chinese dives. Why, they tell me there is nothing in Paris, nothing anywhere to equal the depravity of San

Francisco. It was God's judgment, this earthquake. I believe it. I believe it."

With the wondrous changes in the earth's strata which occurred in San Francisco in a few moments on Wednesday, came corresponding changes in the social, financial, business, racial and other strata in the beautiful city near the Golden Gate, which, if not as thrilling, yet were almost as interesting as the mighty upheaval by nature's great forces. Just as quickly as were proud buildings leveled to the ground, just so quickly were leveled the barriers which had separated folk in all walks. In a twinkling the whole structure of city life was changed, just as was the physical structure, and the contrasts made by the changes were just as marked.

Following the shocks came a stupor which fell over all. As the horror of the situation grew upon them the feeling was one of utter hopelessness and indifference to their fate. Men and women walked the streets aimlessly, not trying to avoid falling walls and firebrands, seemingly careless whether or not death would come.

TERRIFYING SCENES IN CAMPS.

The scenes in the camps of refugees which dotted the city were terrifying in their very simplicity—men and women appear to have returned to the primitive—the disaster had left no distinctions. Those who a few short days before enjoyed wealth and social distinction lived in their rude hovels or wandered about the street, suffering from the first pangs of hunger they had ever known, without a murmur or complaint.

Deaths and burials went on without grief; births were heralded without joy, save for the women who crowded about the shelters and fondled the little ones who gazed for the first time in life on a scene of strife and misery. Altogether the women bore the calamity better than the men. Starvation had for them but little terror, and they roamed aimlessly around unmolested in and out of the ruins and thronging camps without fear.

The human passions were mingled strangely in this vast city where suffering prevailed. Late Friday night a young woman who was Tuesday the mistress of every luxury she could wish was seated with a group of tearful shop girls near the city side of Golden Gate Park. A costly robe had been blackened and burned by the falling ashes. A staggering figure—

that of a man—appeared, making its way wearily from the city. Near the group he fell. The crushed crown of an opera hat was stuck grotesquely on his head, a broad expanse of what had been an immaculate shirt front was reddened and grimy from the blood which flowed from a deep gash on his forehead. His face was black, his throat so parched that he could not utter a sound.

The girl caught him as he fell and sat with his head in her lap while from his lips issued strange unearthly sounds until death came. The man was a young broker, well known in San Francisco, and the girl was his fiancee. They had attended the opera on Tuesday night, and when they met again he had been working in the midst of the fire district for almost seventy-two hours. The girl held his lifeless body until a detail of soldiers were forced to wrest him from her, and he was buried.

"THANK GOD FOR THE REGULARS."

"Thank God for the regulars," said everybody. They were the steadfast hope of the people and policed like heroes and ruled like fathers. In the central part of the city they checked the outrageous famine prices to starving people. When Thursday morning broke, lines formed before the stores whose supplies had not been commandeered. In one of these the first man was charged seventy-five cents for a loaf of bread. The corporal in charge at that point brought his gun down with a slam.

"Bread is ten cents a loaf in this shop," he said.

It went. The soldier fixed the schedule of prices a little higher than in ordinary times, and to make up for that he forced the storekeeper to give free food to several hungry people in line who had no money to pay. In several other places the soldiers used the same brand of horse sense. There were no cases reported of actual starvation, although many came into Oakland hungry, ready to grab food and choke it down like animals.

The soldiers took the cue from General Funston. He was the real ruler of San Francisco, and was doing the best job he could. Thursday all the military tents available were set up in the Presidio and the troops were turned out of the barracks to bivouac on the ground. In these shelter tents they were placing, first, the sick; second, the more delicate of the women, and third, the nursing mothers.

Thursday afternoon General Funston ordered the dead buried at once in a temporary cemetery in the Presidio grounds. The recovered bodies were carted about the city ahead of the flames. Many lay in the city morgue until the fire reached that; then it was Portsmouth Square until it grew too hot; afterward they were taken to the Presidio. There was another stream of bodies which had lain in Mechanics' Pavilion at first, and had then been laid out in Columbia Square, in the heart of a district devastated first by the earthquake and then by fire.

The condition of the bodies was becoming a great danger. Yet the troops had no men to spare to dig graves, and the young and able-bodied men were mainly fighting on the fire line or utterly exhausted. It was Funston who ordered that the old men and the weaklings should take the work in hand. They did it willingly enough, but had they refused the troops on guard would have forced them. It was ruled that every man physically capable of handling a spade or a pick should dig for an hour. When the first shallow graves were ready, the men, under the direction of the troops, lowered the bodies, several in a grave, and a strange burial began. The women gathered about crying. Many of them knelt while a Catholic priest read the burial service and pronounced the absolution.

GIRL FOLLOWS FATHER'S BODY.

Many of the dead, of course, will never be identified. A story came of one young girl who had followed for two days the body of her father, her only relative. It had been taken from a house on Mission Street to an undertaker's shop just after the quake. The fire drove her out with her charge, and it was placed in Mechanics' Pavilion. That went, and the body rested for a day at the Presidio, waiting burial. With many others, she wept on the border of the burned area, while the women cared for her.

The sacrifices were innumerable. A man who had in some manner obtained a bottle of water and was hurrying to share it with a comrade before touching it himself, was checked by the sight of a dry-eyed woman fondling a wailing infant. Thirst was stamped plainly on their faces. The man started to pass on. A second cry again stopped him, and he turned and thrust the precious bottle into the woman's hands.

"Give it to the kid," he said. "I'll get some more." And he started back on his hopeless quest. The man was one of the most notorious characters in the Tenderloin, and it is understood later he was bayonetted by soldiers while in the act of looting a house.

It was in the city's many parks where the refugees gathered that the strangest sights of the week were seen. By each little group, lying out on the grass and under the trees, would be a small bundle of household belongings. Up and down the broad avenues of the parks the troops patrolled, keeping order. This was difficult at times, for the second hysterical stage succeeded the paralysis of that first day, and people were doing strange things. A man, running half naked, tearing at his clothes and crying, "The end of all things has come!" was caught by the soldiers and placed under arrest. Under a tent on the broad lawn of the children's playground a baby was born. By good luck, there was a physician there, and the women helped out, so that the mother appeared to be safe. They carried her later to the children's building in the park and did their best to make her comfortable.

DEATHS CAME FREQUENTLY.

The deaths came frequently. Physicians were everywhere in evidence, but without medicine or instruments were fearfully handicapped. Men staggered in from their herculean efforts at the fire lines, only to fall gasping on the grass. There was nothing to be done. Injured lay groaning. Tender hands were willing, but of water there was none. "Water, water; for God's sake, get me some water," was the cry that struck into thousands of souls of San Francisco.

From Fort Mason, where most of the Italians and Spaniards from Telegraph Hill had passed the night, there started an early morning exodus, Friday, for the ferry. A priest of the Church of St. Peter and Paul—the Church of the Fishermen they call it in San Francisco—had saved from the church the Host, vestments and sacred vessels. Early in the morning he set up an altar in the open and said mass.

One of the refugees on the shores of Lake Merced, Thursday morning spied a flock of ducks and swans which the city maintained there for the decoration of the lake. He plunged into the lake, swam out to them and

captured a fat drake. Other men and boys saw the point and followed. The municipal ducks were all cooking in five minutes. A man with a loaf of bread in his hand ran up to a policeman on Washington Street. "Here," he said, "this man is trying to charge me a dollar for this loaf of bread. Is that fair?"

"Give it to me," said the policeman. He broke off one end of it and stuck it in his mouth. "I am hungry myself," he said, when he had his mouth clear. "Take the rest of it. It's appropriated." The regulars, who had been remarkably cool and had not had a wink of sleep, had strict instructions to brook no interference, and but few quarrels arose. These were stopped with bullets.

In contrast to the action of the men from the Government reservation, calm, self-contained and decisive, was that of the volunteers and the various cadets who had been sworn in to do police duty. The experience of carrying loaded arms resulted disastrously in a number of instances.

A group of cadets were standing near a half-burned home when a man made his appearance and started to enter. The boy—he was scarcely more than nineteen—called to the man to halt, and when the other turned and started towards him, the lad, his arms twitching with nervousness, raised his rifle and fired. The other fell mortally wounded. It was subsequently learned that the man killed was entering his own home.

SUFFERER MAKES LARGE DONATION.

Mrs. Hugh Crum, a wealthy property owner, reported to the Relief Committee that all her income-bearing property had been destroyed, but that she had a little money in the banks which she proposed to divide equally with the Relief Committee. She, therefore, subscribed $10,000 to the relief fund. Many other persons of comfortable circumstances were coming to the aid of the committee, and food supplies of all kinds were being furnished the needy.

For two days and nights a squad of police were performing patrol duty in Golden Gate Strait. Two lieutenants and eight men aboard the tug "Sea Rover" Friday night prevented the departure of several vessels from the harbor for the reason that they carried food. Among them were the barkentines "Eureka" and "Barracuda," bound for Portland, with

considerable supplies on board. All vessels stopped and were compelled to drop anchor in the stream or return to the dock, where the food was unloaded and turned over to the authorities.

There was another side to the work of the troops. The looting grew, and with the irritation of burning nerves the men became more impatient of looters and lawbreakers. There were mistakes and there were excesses of authority. One man was shot in the burned Mission district for washing his hands in drinking water, which had been brought in at great trouble for the thirsty people packed into Columbia Park. It was said, also, that a bank clerk, watching the ruins of his bank under orders, was killed by a soldier, who thought that he was looting. There became a persistent rumor of an attempt to rob the Mint, in which a number of robbers were shot. The shooting of men actually engaged in looting became more and more common. Life was cheap for those who did not respect military rule on the edges of the burning hell.

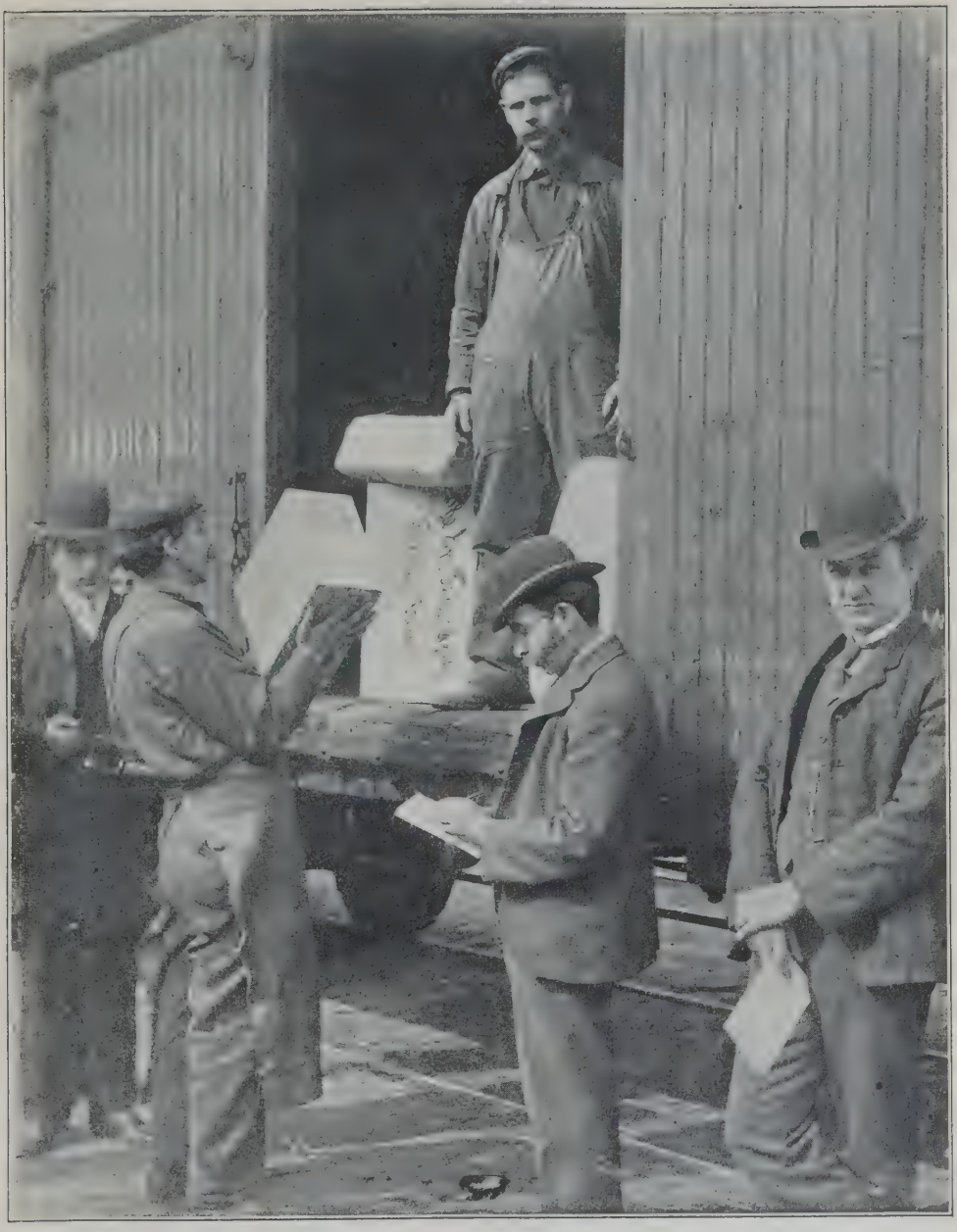
The consideration which was shown by men of all classes to the women appeared remarkable. The cases of insult to the unprotected—of whom there were thousands—were few.

KILLED FOR INSULTING GIRLS.

Strict orders were given to the military regarding the protection of the weaker sex, and were carried out to the letter.

In Golden Gate Park, which resembled a vast bivouac, with its myriad of twinkling campfires, two young girls were accosted by two men, evidently the worse for liquor, which they had obtained in some way. The girls were dressed in hurriedly-snatched ball gowns, donned during the first terror of the earthquake. Scarcely had one of the men spoken when, without a word of warning, a sentry from the Presidio, who was standing near, fired and the man dropped, a bullet in his heart. The other man started to run, but was brought down by a second shot and placed under guard.

All Thursday wagons mounted with barrels and guarded by soldiers drove through Golden Gate Park doling out water. There was always a crush about these wagons and only one drink was allowed to a person. Separate supplies were sent to the sick in the tents. The troops allowed



First train load of supplies sent out by The Evening Telegraph for the relief of sufferers in the stricken city.

CHARLES CROCKER MANSION, Nob Hill, San Francisco.

STREET SCENE IN CHINATOWN, SAN FRANCISCO.

CONSERVATORY, Golden Gate Park. It is modelled after the Royal Conservatory at Kew, England, and contains the famous Victoria Regia.

PARK PANORAMA. Situated on Strawberry Hill at an elevation of 426 feet. From this point visitors have a magnificent view of the Cliff House, Oakland, and South San Francisco, and a long line of beautiful sea beach.

MISSION DOLORES. The oldest building in San Francisco, and the most notable one in the Mission Church. It was founded October 8th, 1776.

NEW FAIRMOUNT HOTEL on Nob Hill. Powell and Sacramento Sts.

ALCATRAZ ISLAND, in San Francisco Bay. A Government Reservation. The United States Military Prison is located here.

UNIVERSITY OF CALIFORNIA, Berkeley, Alameda County. The buildings are located on a gentle slope of the foothills. This is one of the finest educational institutions in the world.

VIEW ON MARKET STREET, San Francisco.

MINING CAMP IN CALIFORNIA ON THE DISCOVERY OF GOLD IN 1849.

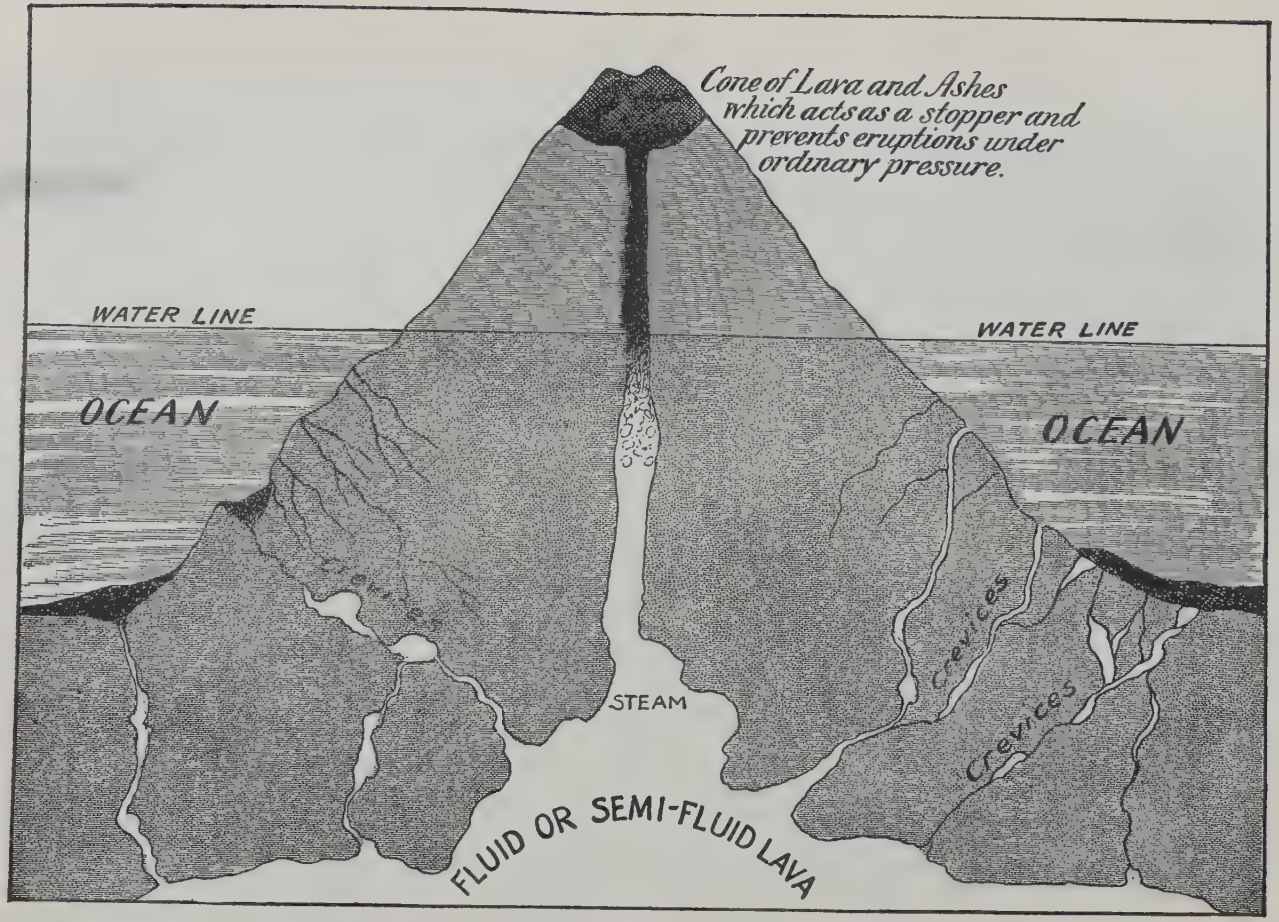


DIAGRAM SHOWING HOW VOLCANIC ERUPTIONS ARE PRODUCED

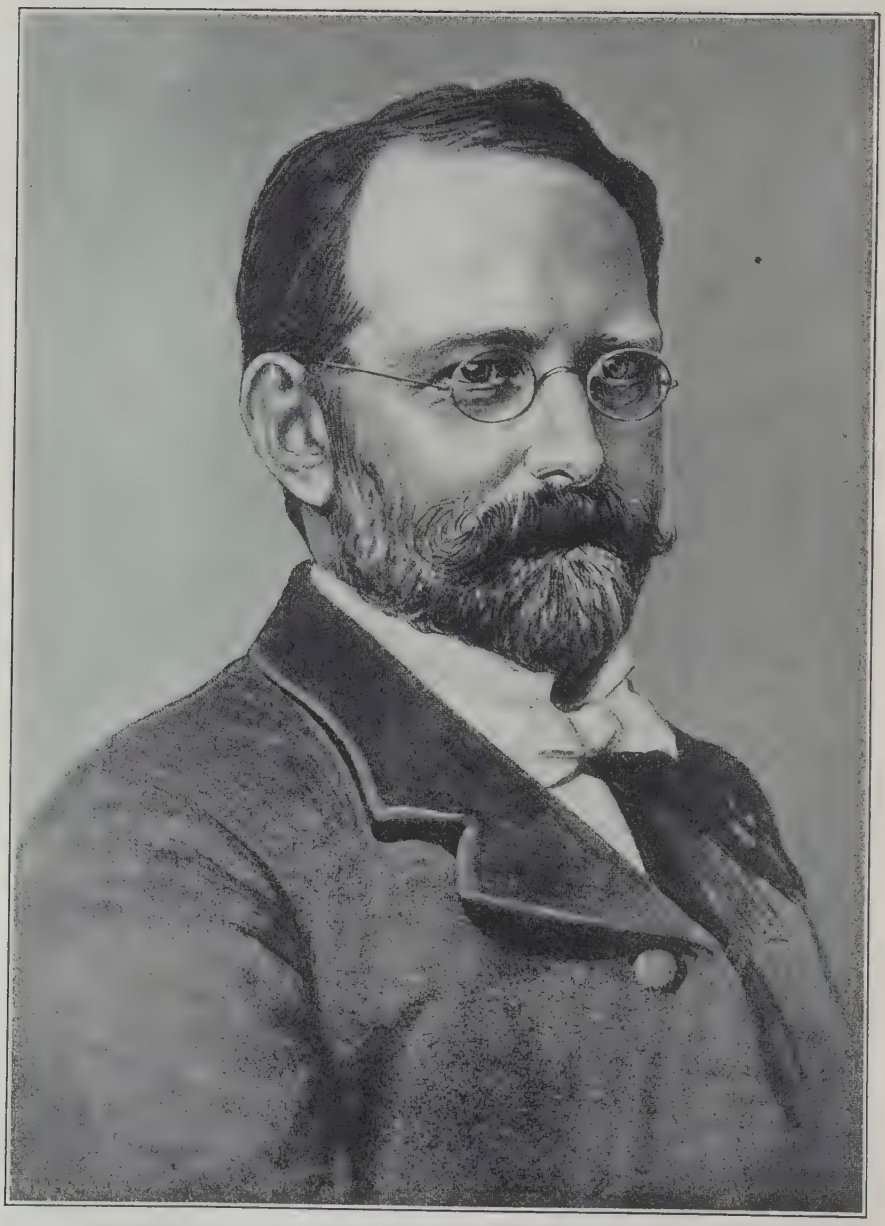
WATER COMING IN CONTACT WITH MOLTEN LAVA IN THE VOLCANO'S INTERIOR GENERATES STEAM AND CAUSES AN EXPLOSION AS STEAM DOES IN A WEAK BOILER

MAGNIFICENT RESIDENCE OF JAMES L. FLOOD, Nob Hill, San Francisco.

GENERAL FREDERICK FUNSTON

IN COMMAND OF THE FEDERAL TROOPS AT SAN FRANCISCO DURING THE GREAT EARTHQUAKE AND TERRIBLE CONFLAGRATION.

MAYOR EUGENE E. SCHMITZ of San Francisco, Cal.



GOVERNOR PARDEE of California.

no campfires, fearing that the trees of the park might catch and drive the people out of this refuge to the open and wind-swept sands by the ocean. The wind, which had saved the heights, came cold across the park, driving a damp fog, and for those who had no blankets it was a terrible night. Many were exhausted and could not sleep even in the cold; they threw themselves down in the wet grass and fell asleep.

When morning came the people even prepared to make the camp permanent. An ingenious man hung up before his little blanket shelter a sign upon a stick, giving his name and his address before the fire wiped him out. This became a fashion, and it was taken to mean that the space was pre-empted.

CHAPTER XIII.

CREMATING THE DEAD AND FEEDING THE LIVING.

WITH eyes on the future and with memories of past prosperity acting as inspirations rather than discouraging sorrows, San Francisco seemed to have forgotten its comfortable homes and the luxuries of the metropolis and came back to first principles. The people entered into the spirit of beginning again, and were accepting camp life philosophically and as a part of the process of the return of better things. All were fed, there was water for all and the relief measures were progressing with the orderly routine instituted by the civic and military authorities. This was the fourth day after the disaster.

One of the many measures taken to prevent the spread of disease was the burning of 200 bodies found in the Protero district, south of Shannon Street, in the vicinity of the Union Iron Works. These bodies were cremated at the Six-Mile House by order of Coroner Walsh, and the announcement was made at the Board of Health headquarters. So many dead were found in this limited area that cremation was deemed absolutely necessary to prevent an epidemic of sickness. The names of some of the dead were learned, but in the majority of cases identification was impossible, owing to the mutilation of the features.

The total number of bodies recovered up to Sunday night and either buried or burned was 500. No complete record could be had, as many bodies were buried without permits from the Coroner and the Board of Health. The searchers of the Coroner's department and the Board of Health found twenty bodies during the day. Whenever a body was found it was buried immediately, without any formality, and these burials were made at widely separated points.

The body of an infant was found in the center of Union Street, near Dupont. There was nothing by which it could be identified. It was learned, however, that a number of persons had camped at this place, and it is presumed that the child died and was left when the party was forced to move. Three bodies were found in the ruins of a house on Harrison

Street, between First and Second. They had been burned beyond all possibility of identification. They were buried on the North Beach.

Operators on duty at the Market Street ferry house were frightened by the noise of some timbers falling in the afternoon, and, believing that another earthquake shock had occurred, fled from the building. The news that a new earthquake shock had visited the city was flashed across the country, but the report was contradicted quickly.

The authorities announced that the food supply was ample for the present, and that the city mains were carrying water which would soon be enough to meet all needs.

The sanitary conditions were improving under the efficient work of the health officers and volunteer engineers, who were also preparing to clear the streets. Governor Pardee, of California, announced his belief that the salvation of the city was being worked out successfully, and that a finer metropolis would be reared over the ruins.

WATER SUPPLY RESTORED.

Experts of the Spring Valley Water Company, who had been engaged in making a thorough examination of the mains and reservoirs of the system, reported that the company had in its reservoirs enough water to supply the city at the regular rate of 35,000,000 gallons per day for a period of 600 days. The only immediate problem was that of getting this supply of water into the city. Already pipes had been repaired in certain sections, and a supply of 7,000,000 gallons per day was coming in through Ocean View from Lake Merced. About 1,000,000 gallons of this was being consumed daily by Ocean View and the other towns along the pipe lines, but 6,000,000 gallons daily was reaching and would continue to reach the city proper.

The Board of Health reported a very encouraging health condition, considering the circumstances. Sickness was constantly on the decrease. Sanitary conditions in the residence districts were being improved. Major Frank Keesling, in charge of Golden Gate Park, made this report to General Funston:

"I beg to advise you that not a case of serious sickness exists in this park. All rumors to the contrary are false and malicious. I will promptly

advise you if there is any change, or if anything of a serious nature occurs."

The Engineering Department of the United States Army, having in charge the work of erecting temporary buildings in Golden Gate Park for the relief of the sufferers, announced that eight buildings were finished. These buildings were cut into compartments large enough to furnish sleeping room for a family, and each compartment had an entrance from the outside. Lumber was being delivered at the park in large quantities, and 135 carpenters were at work on the temporary buildings.

A large corps of volunteers started at work on Saturday removing all cans of garbage to the curbs. Wagons were being pressed into service and the garbage removed to the burned districts, where it was destroyed. Most of the sickness was among the people who were living out of doors, and it was upon these cases that the Board of Health was concentrating most of its attention. Hundreds of volunteer doctors, dentists, nurses and helpers were at work allaying suffering. Since the fire occurred there was no lack of volunteers for every kind of work.

GREAT SCARCITY OF BEDDING.

At the emergency hospitals, which were quickly established and attended by many physicians almost within a half hour's notice, the only complaint that really existed was the lack of bedding. Though the army and navy were called on for blankets, quilts and the like, the supply furnished by these departments was not enough, and the physicians feared that these conditions would prove serious if more bedding was not procured. This fear existed particularly at the Presidio and the eastern end of Golden Gate Park, where the winds are brisk and the morning air chilly.

Only thirty patients were quartered in the territory that comprised the park emergency hospital, though 400 persons were treated since Wednesday morning. No deaths occurred at the park emergency hospital after Wednesday morning's shock. Over 100 physicians and attendants were serving in the park. New volunteers and inspectors who were being appointed by the Board of Health were assigned to districts other than the park, as the physicians were assured that the park emergency hospital was under perfect surveillance.

So far no difficulty was met with at the park in securing an ample supply of all that was needed for the care of the injured and ailing. Doctor Rottansi confiscated seven barrels of whisky from a nearby saloon and placed a guard over them, so that the liquor could be available for this purpose.

Oakland furnished an engineering corps to assist in restoring the water supply and another to aid in cleaning the streets. The inspection of the sewers made by the Board of Public Works showed that the outlets to the systems in the residence section remaining unburned were all in good condition save two. In the district south of Market Street few, if any, systems remained. In the business district no inspection was made.

The committee having in charge the relief of the hungry reported that every homeless man, woman and child in San Francisco was being cared for, and that there was no suffering on the score of either food or drink within the city.

The committee was establishing new relief stations wherever needed. In addition, at many points on the outskirts individual or independent organizations were working in connection with the committee. The relief of the needy was being accomplished magnificently. Cars and steamers laden to their capacity with food and medical supplies were pouring into the city from every point along the coast and throughout the State, and as this supply was assured as a permanency, there was not the slightest fear of any lack of food or drink.

DISTRIBUTING CARGO OF SUPPLIES.

The Pacific Mail steamship "China," wtih a cargo including a large quantity of foodstuffs, which arrived on Saturday from the Orient, was docked at Oakland in order that the supplies could be distributed there. The shipping of San Francisco was at a standstill, and such will be the state of affairs while the city is in the least endangered. The United States cruisers "Chicago" and "Marblehead" were stationed off Meiggs wharf and prevented every vessel, whether foreign or domestic, from sailing out of the harbor. The vessels were being held to be ready for any emergency that may arise.

The Federal authorities removed all the customs restrictions from the

cargo of the steamer "China" as soon as possible, and the rice, tea and other foodstuffs from the Orient were taken off the vessel and sent to the aid of the stricken Chinese.

Weddings in great number resulted from the disaster. Women, driven out of their homes and left destitute, appealed to the men to whom they were engaged, and immediately marriages were effected. Since the first day of the disaster an increase in the number of marriage licenses issued was noticed by County Clerk Cook. This increase was getting greater. Saturday morning seven licenses were issued in an hour.

"I don't live anywhere," was the answer given in many cases when the applicant for a license was asked where his residence is. "I used to live in San Francisco."

On Sunday Governor Pardee said:

"The situation is as good as can be expected, considering the greatness of the calamity that has befallen us. The nation and the world are taking great interest in our welfare and showing material and financial aid. The matter of a special session of the Legislature is still under consideration. What we need especially is medical stores, clothing and shelter for the refugees. Of course, food will be needed in considerable quantities for some time to come. An epidemic does not exist at present. It is not probable that there will be any necessity for ordering a quarantine. The work of building San Francisco has commenced, and I expect to see the great metropolis replaced on a much grander scale than ever."

WASHINGTON'S RESPONSE.

The wave of sympathy which spread over the country in response to the news from San Francisco seemed to have its crest in Washington. While President Roosevelt and Congress gave official expression to it, the city itself responded magnificently in contributions. One impressive feature of the situation was the refusal of aid from outside the United States. It is not exaggeration to say that millions of dollars would have come from foreign nations to the treasury of the American National Red Cross if the latter would have accepted the donations. It is a matter of pride, however, with the Government and the American people generally, that they can take care of their own needy.

Messages expressing the sincerest appreciation of the generous tenders of aid were sent on behalf of the Red Cross to the Guatemalan Government, to Canada, to Canadian Pacific Railroad and the Chinese Minister. The Guatemalan Congress voted a contribution of $10,000 to be sent to the sufferers through the Red Cross. The Canadian Government tendered $10,000 and the Canadian Pacific Railroad a like sum.

Sir Chentung Liang Cheng, the Chinese Minister, offered to the Red Cross $4800, which had been contributed by Chinese consuls, members of the legation and other Chinese. This was declined, like all other foreign gifts, but the minister was asked by the Red Cross to send the first secretary of legation to San Francisco to aid in distributing relief to the Chinese in that stricken city.

Word was sent out by the Red Cross through its various agents to have organized in every part of the country clubs or societies of ladies who would undertake the collection of clothing and other necessaries for immediate shipment to San Francisco. These societies were to operate in conjunction with the Red Cross, just as they did at the time of the Johnstown disaster.

LOOKING OUT FOR BABIES.

With keen appreciation of the danger threatening the babies in San Francisco, the Red Cross at St. Louis dispatched a carload of condensed milk to the coast. Its agents also all through the West began the systematic purchase of fresh eggs, the supply of which in nearly all of the cities in California was reported as exhausted. These purchases were being made in the States just east of the coast and were being made through army officers at army prices.

Treasurer Keep, of the Red Cross, in Washington, reported on Saturday the receipt of $40,000, in addition to $50,000 received the day before. With the contributions made to the New York branch, a fund of half a million was already available. The funds are being telegraphed to Judge Morrow, the California agent of the Red Cross.

On Sunday a special train left Washington, carrying medical officers of the army and navy. It was the purpose to pick up army doctors en route until at least one hundred would be carried to San Francisco. The

activity at the War Department continued as intense as ever. There was no cessation in the orders for supplies of all kinds, and many officers in the department had no sleep for two nights.

The following appreciative tribute to the magnificent response for help is by one of our leading newspapers:

"The one ray of light in the gloom created by the calamity at San Francisco is afforded by the truly magnificent display of brotherly love and sympathy shown, not alone by the people of this country, but by those of the whole civilized world. The hearts of men and women have been deeply touched by the blow which has fallen on their fellows, and they are showing by deeds of generous helpfulness, on a scale almost unprecedented in the annals of a free-handed and lavish people, those higher qualities of heart and mind which ennoble mankind and differentiate it from the brute creation.

NATION STIRRED TO CHARITY.

"In the face of an appalling and death-dealing disaster, rendering an entire community dependent for the bare necessities of life and putting it in imminent danger of greater horrors, the nation has been stirred as it has not been for many generations, and there have been awakened those deeper feelings of brotherhood which are referred to in the oft-quoted passage about the kinship aroused by 'one touch of nature.' It is impossible for the finite mind to imagine the full extent of the misery and suffering created by such an upheaval of the elemental forces of nature as that which has occurred on the Pacific Coast; the attempt to picture the details even vaguely makes too great a draft upon the imagination, too terrible a drain on the sympathy.

"But the simple realization that thousands of fellow-beings are perhaps at this moment suffering for food and water, for clothes and shelter; that the visitation which has come to one community may at any moment be the fate of others—it is this 'one touch of nature which makes the whole world kin' and translates the feeling of sorrow and pity into action. There is something incomparably splendid in the spectacle of an entire nation straining every nerve to send succor to the helpless and the suffering, and this spectacle has warmed the hearts that were stunned by the

magnitude of the calamity. The nation is finding relief in action, the universality and spontaneity of which is one measure of the sincerity of its grief and its sympathy.

"Such a spectacle as is now being presented throughout the length and breadth of this land, and in many another land as well, where cities and towns, corporations and individuals, are vying with one another in generous rivalry as to which shall be the first to feed the hungry and succor the suffering and the shelterless, must be a grateful one to all who have preserved their faith in the higher ideals and destinies of the race.

"What is going on to-day all over the world, but particularly throughout America, must give the lie to the pessimist and the croaker, for it reveals the falsity of the version which pictures modern society as wholly cynical, selfish and indifferent. Preoccupied it may be; too often engrossed in its own affairs to notice the prosaic every-day instances of wrong and suffering it often is; but when aroused by some great emergency, the real heart of humanity is revealed and the world is the better for the awakening. No good deed is ever lost, either to the recipient or the doer, and the gracious effects of such an outpouring as the present will be a double benediction.

NEW AND SPLENDID CITY PROMISED.

"Where San Francisco lies prone in its ashes, and looks up to its desolated hills, will arise a new and splendid city. Yet when it has been builded, and the bitterness of the present time forgotten, then will abide a sense of loss. The old San Francisco is no more, and never can it be recalled save as a memory. The local color, atmosphere, that which might be termed temperament, vanished with the clustered houses, as rich in tradition as the ancient missions in whose cloisters worshiped the Spanish padre 'before the Gringo came.'

"While many Americans knew San Francisco, more of them knew Paris, London and Rome. To most of them this fair city of their own land was as a place distant and foreign. But such as entered it, and learned of its people and their ways, learned to love it. Unique it was, almost grotesque perhaps, certainly defiant of precedent in its customs, its pleasures, its manner of living. One who had stood on an eminence there,

beholding a vision of ocean, bay and circling mountains, had seen the billowing fog banks roll in through the Golden Gate, crowning the abrupt slopes of Saucelito until in the sky there seemed a range of fantastic mountains, in their phantom valleys shifting lakes that changed tints with the sun, remembered ever after a panorama beautiful and appealing. This picture no fury of rocking earth may destroy.

"But the scenic impressiveness only prepared the mind for appreciation of that part of San Francisco which has been swept into history, and which hardly may be described. It was a very essence, a subtle difference, not so much in mental attitude and moral perception and warmth of fellowship—although all of these quickly might be discerned—as in the form of the expressions these qualities had taken. One of San Francisco's charms was in its defiance of precedent. There were hills to be conquered, and San Francisco's expanding traffic hurled itself at the face of them. It went up and up, with no thought of finding a way around. So it happened that on some of the streets the steepness was too great for horses. In the centre there are cable roads, and on either side of the rails grass grows through the cobbles.

OLD BUILDINGS OF THE TOWN.

"The earlier structures on the level were put together in haste. For the most part they remained essentially unchanged until they fell with a crash. True, they had become stained by time, unkempt, dwarfed by new neighbors, but nobody desired to efface them. Away from the business section houses appeared on the various hills, perched precariously near the brink; houses reached by long flights and grown over with roses. The bathing fogs touched them with gray. Mosses grew on their roofs. In the little, lofty yards calla lilies bloomed with the profusion of weeds. But inside these homes what hospitality! as inside the rickety restaurants down toward the water front there was cheer. The 'two bit' dinner of the Italian or Mexican chef in New York would have cost ten times as much. Those whom they drew into comradeship, no matter from what rank in Bohemia or of Philistines astray, were made acquainted with a pervasive equality not witnessed elsewhere in civilization.

"The natural beauty of the site, the quaintness of the commercial and

social development of which it became the centre, attracted the poet and the artist. It incited them to paint the attractions and to sing the praises of their chosen habitat. For the outside world, who cared? Surely not they. They lived in a world of their own, and it was good enough. Now and then some member of the group went to the larger world outside, and perchance found fame, but the heart of the wanderer turned back to the gray and shadowy city.

"Here Stevenson paused before going to the islands to die, and made his home in a rookery. Happy and content was he, as he sat for hours in Portsmouth Square, where now a monument to his memory has been jarred askew. Here young Norris gathered the inspiration for his books. Here, too, in an older day, Bret Harte did his best work and Twain found his real beginning.

THE NEW MARCH OF IMPROVEMENT.

"On another plane—that of the clubs—there prevailed a similar habit. Pleasure was courted; to offer the stranger greeting was part of the code. To instruct him that however desirable a place he had come from it must be less desirable than San Francisco was a matter of course; never done aggressively, but with the final word that admitted no denial. This higher Bohemia has suffered, too, but it can survive. The club may rebuild, with the stores, the offices and the mansions, and be better equipped than ever. The spirit of the club has not been crushed. It is in the humbler walks that the blow has fallen. The antique structure that no fire ordinance would permit in a modern city; the elevated cottage that the architect never dreamed; the uprising street ending against a cliff, all these the march of improvement will obliterate, scattering the people to whom they were dear, and making all things new, precise, according to rule.

"Even the absence of Chinatown will be a loss. There never will be in America such another. Garish with gold and purple; rich in secrets the police had failed to fathom; its people retaining the dress and traits of the Orient; honeycombed with subterranean passages; full of strange sights and sounds and smells, with the contrasts of riches and squalor, industry and vice, it was alone of its kind. It occupied some of the best territory, and long had been wanted for other purposes. Now the Chinese really

must go, and the odor of sandalwood and opium, the stores of scented drugs, inwrought vases and carved ivories sought by every traveler, must be sought elsewhere.

"The people of San Francisco know the shock of calamity, but they do not know defeat. They will have their city again. It cannot be the old city, nor suggestive of the old. Disaster seems to have swept away the barriers that afforded pleasing isolation. The new San Francisco will be as other prosperous cities, its distinctiveness only that which springs from its site as an outpost overlooking the Pacific."

The following account of San Francisco will be of special interest to the reader:

San Francisco's history leads back to the days of '49, with their romance and their glamour; days when a trip to the Pacific was an arduous task of months across plains where hostile natives harried; or in the mountains, with the peril of avalanche and flood. The other course was around the Horn by ship, or across the Isthmus, where the menace of fever lurked. The result was that the early settlers were men of reckless daring or exceptional hardihood. The women who followed were of two classes. One was made up of adventuresses; the others were women of high character, a courage as lofty as men ever knew, and happily for the development of the West the latter women became the social basis, the motherhood so distinct that it seemed for a generation that of a new people.

DEVELOPING THE MINING CAMP.

The Eastern settlers found the Spanish in full possession. Castillian beauty reigned, with the house of the commandant at the Presidio a sort of centre. The Spanish element soon was crowded out, and by process in part legal, and in all respects inevitable, the aliens took full possession. To-day the Spanish linger only in names that the settlers never disturbed, although the trace of their blood is to be seen in the tawny cheek of many a native Californian proud of his ancestry.

For a time the development of San Francisco was that of the average mining camp. The people had no thought that on the peninsula dividing the ocean from the placid bay they were to find a permanent abiding place. They were far away from the Federal Government, and they had no regu-

larly constituted courts. Disorder had to be dealt with, and when the territory had formally become American this duty was undertaken. The lawless were convinced with suddenness that there was law, and that its arm was mighty. The thief, the thug, the crooked gambler, were given fair warning and then short shrift. Portsmouth Square, the place now opposite the Hall of Justice, and whither citizens scared by the earthquake fled for refuge, was the scene of many a hanging. The people who acted as judges and executioners were the best of the day, and some of them live yet to recount the tale, while their children have developed into the leading spirits of commerce, education and social growth.

From the time of its founding San Francisco has been the most important city of the Pacific Coast. Built on a peninsula, it covers forty-seven miles about midway of the Californian Coast. Its safe and ample harbor and the fact that it was the outpost of possible expansion made its greatness a certainty. It has had its ups and downs, but never a doubt as to its ultimate destiny. While much of the business part of the city is virtually at sea level, the residence portions are several hundred feet in elevation, this being true of Nob Hill and Pacific and Presidio Heights. In addition to these, Russian Hill rises almost cliff-like in the side it presents to the sea, while the same may be said of Telegraph Hill, an eminence that stands just where the waters of the bay curve gracefully to join the narrow strip that leads out through the Golden Gate, giving ships their sheltered passage to the open sea.

ONE OF THE WORLD'S PICTURESQUE CITIES.

San Francisco is—or must the record be was?—one of the most picturesque cities in the world. Its skyline, serrated by domes and pinnacles, was deeply impressive, whether viewed from across the bay or from the ocean. Even the fogs that often enwrap it lent to it a mystic charm. The town of San Francisco progressed moderately for a number of years, and then the great fortunes that had been made began to be devoted to its upbuilding. Fashionable folk erected mansions on Rincon Hill, a locality long ago abandoned by them. There they lived in homes decorated by foreign artists.

In later years San Francisco began to have its millionaire class. One

group of four comprised Stanford, Hopkins, Crocker and Huntington. They built the Central Pacific Road, and out of it each made stupendous riches. Three of the four signalized their new estate by putting up on California Street a series of palatial homes. Huntington did not build, but subsequently bought a house adjoining Crocker's, it being the duplicate of a famous Italian villa. The Stanford and Hopkins houses ultimately became the property of the State University. The others generally stood empty, save for caretakers. All have been destroyed. All the builders are dead. Huntington having survived the longest.

THE MACKAY GROUP.

Another group of four of equal celebrity was made up of Mackay, Fair, Flood and O'Brien. Their money was made in mining and in stock speculation. When first taken with the idea that the Comstock held wealth for them they were engaged in running a saloon at the scene of the Nevada excitement. All excepting Mackay have long been dead. Before his death Mackay was known to the world as the leader in great enterprises. The men of these groups left their distinctive mark upon San Francisco. They put their money into advancing it. They inspired a faith in the city. Their sons are now known in the world of finance, and their daughters are familiar figures in the society that draws upon the capitals of the world.

The climate of San Francisco is unique. There is neither heat nor cold known to it. There is no series of four seasons, but a division into wet and dry, the winter being the wet. Semi-tropical plants flourish in the open throughout the year. The parks are at their greenest and the trees in fullest splendor at the Christmas holidays. Roses bloom every month of the year. The clothing worn is of the same weight during the twelve months. Many houses had no method of heating, and others had open fireplaces, where there is as likely to be a blaze in summer as in winter.

Most of the streets are wide, although this is not the case in the lower quarters. They were lined with a good class of houses, with a large share that were fairly entitled to be called mansions. Even the most costly of these, as a rule, were of wood. The Flood house, costing more than a million, and that of Claus Spreckels, the two of his sons, John A. and Adolph, and that of one of the Crockers, were exceptions.

In the adornment of its streets and parks, and in its public buildings, San Francisco was lavish. So, too, have its capitalists been in the finish of business buildings. The banks, stores, hotels and offices of San Francisco, in every detail of artistic nicety, equaled those of New York. But even the waning of the old fear of earthquakes never permitted the buildings to be sent so high as they go in any Eastern city, eighteen stories being the limit, and twelve a standard for modern structures.

THE MUNICIPAL WORKS.

The city government has been able and measurably free from corruption. It is virtually without a debt, and has a habit of having in its treasury several millions of dollars in actual coin. The public libraries would be a credit to any city. The municipal buildings were on a generous scale, and architecturally much commended. In the matter of fire protection, light and transportation facilities there was no city in the land more advanced. The Mayor preceding the present incumbent, Schmitz, was James D. Phelan, whose father made a vast fortune in trade, and who is a public-spirited gentleman. Although one of the heaviest individual losers by the catastrophe, he, together with Claus Spreckels, whose individual loss also runs into the millions, was quick to subscribe liberally for the benefit of the suffering. Such an act may be cited as showing the spirit that built one San Francisco, and viewing the ashes, undismayed, sets about building another.

As the city grew there were acquired forms of wealth that cannot be stated in dollars. It was the seat of museums, of art collections, of noble private libraries. Its churches, rich in appointments, had begun to become hallowed with age. Its schools, its clubs, its restaurants, its palaces stocked with goods, have been destroyed, but with them more than mere material. They all bore the mark of the local color, an atmosphere observed in no other place. San Francisco was unique among American cities, clinging to customs and respecting traditions. Years ago, when communication was by steamer, and the steamer called every two weeks, settlements had to be made twice monthly. That circumstance established "steamer day" and "steamer day" was still a fact, to the sudden ending of business.

CHAPTER XIV.

UNSHELTERED THOUSANDS IN THE PARKS DRENCHED BY RAIN.

DRENCHING rain fell upon San Francisco Monday night. From midnight until 3 o'clock it poured and drizzled at intervals, while a high wind added a melancholy accompaniment, howling and sighing about the buildings of the burned district. Five days before, when the fire catastrophe was in its infancy, this downpour would have been regarded as a mercy and a Godsend. Monday morning it could be regarded in no other light than as an additional calamity.

It meant indescribable suffering to the tens of thousands of persons camped upon the naked hills and in the parks and open places of the city. Few of these were provided with waterproof covering. For the most part their only protection from the wet was a thin covering of sheeting tacked upon improvised tent poles. Through this the water poured, wetting the bedding and soaking the ground upon which they lay. When it is understood that thousands upon thousands of delicately-nurtured women and infants in arms, and old and feeble persons, were in this plight, nothing need be added to describe the misery of their condition.

The downpour aggravated the already unsanitary condition of the camps and added great numbers of pneumonia cases to those already crowding the regular and temporary hospitals of the city. What could be done was done by the guards in charge of the camps to relieve the distress. Wherever covering could be had for the women and children it was taken advantage of. They were housed in chill and cheerless churches, in garages and barns, and those who had saved their homes were called upon to take care of the unfortunates exposed to the storm.

With few exceptions those who had homes responded readily to the new call made upon them, and where they did not the butt ends of rifles quickly forced a way through inhospitable doors. While the storm added to the difficulties of the general committee, especially of those having in charge the care of the sick, the sanitation of the city and the housing of the

homeless, it was a spur to even greater efforts to bring order out of the chaos prevailing.

Regular shelter tents were to be provided, as well as cots standing off the ground. It was realized that these provisions were imperative, as much so as the providing of food. After several hours of clear weather there was another precipitation at 6 A. M., and again at 9 o'clock the fall was resumed and continued at intervals throughout the day.

MAN'S EFFORTS FOR FAMILY.

Of individual instances of suffering the number was legion, but one will tell the story of them all. About 4 o'clock, when the rain had been falling heavily for an hour, a middle-aged man, white-faced in his distress and fatigue, appeared at the headquarters of the general committee. He had walked two miles from his camping place in the park to make an appeal for his suffering wife and little ones.

As he told of their distress tears coursed down his cheeks. His wife and children were, he said, without covering other than a sheeting overhead, and were lying on the naked ground, and their bodies protected only by a quilt and blanket, which of his household bedding were all he had managed to save. These had quickly been soaked, and, while unwilling to complain on his own account, he could not bear to listen to the wails of his loved ones, and had tramped all the way from his camping place to the committee headquarters in the hope that there he might find some means of getting his family under shelter.

Major H. C. Tilden, a prominent commission merchant of this city, a member of Governor Pardee's staff and one of the foremost workers of the General Relief Committee, was shot and almost instantly killed in his automobile early in the morning at Twenty-second and Guerrero Streets, while returning from Menlo Park. He was shot by members of the citizens patrol. Hugo Alltschul, a coachman, who was in the automobile, was cut in the face by a bullet, and another ball pierced the seat and struck the back of R. G. Seaman, acting lieutenant of the Second Company of the Signal Corps. The force of the bullet was spent and Seaman suffered no injury.

Major Tilden had taken his three children and a nurse from the

Fourteen-Mile House, where they had been since the earthquake, to Menlo Park, where he had a summer cottage. His automobile had been used as an ambulance in conveying sick and wounded to the hospitals, and the Red Cross flag was displayed on the car. Besides this, he had the Red Cross insignia on his right arm. According to Seaman, six men stood in the middle of the road at Twenty-second and Guerrero Streets, separating when the car got within fifty feet of them. When the car was within ten feet of the guard, Seaman says, the guard began shooting without warning or challenge, and kept on firing after the car had passed them.

"The car had gone about fifty feet past the patrol," said Seaman, "when it stopped suddenly. Tilden, who was operating the car, fell towards me, saying, 'Well, they got me—they killed me.' He then dropped back in the seat and rolled out of the car.

"I sprang up and fired five shots in quick succession at those who were still shooting behind us. A doctor came running from a house near by, and, after examining Tilden, said he was dead. Several policemen came running up and arrested three of the men who did the shooting."

The killing of Tilden caused the greatest indigation. Boyneton, one of the men under arrest, declares that he did not see the Red Cross flag on Tilden's car, and when the latter did not stop when challenged, he fired. Seaman then began shooting and Simmons and Vance replied.

LIGHTS IN THE HOUSES.

Sunday night was one of almost stygian darkness, the silence broken by the measured tread of patrols and sentries, and an occasional shot. For the first time, lights were allowed in the houses, but only from dark until 10 o'clock.

A temporary detention hospital was established in the basement of the Sacred Heart School conducted by the Dominican Sisters, at the corner of Fillmore and Hayes Streets, and the first commitment since the earthquake was made yesterday. The sisters of the Sacred Heart kindly turned over a part of the already crowded quarters to the insanity commissioners, and a number of patients were housed there. An insane Chinese at the Presidio Hospital was killed by a delirious Federal patient. The Chinaman's skull was crushed with an iron bar.

A permanent sanitary camp for the Chinese left in the city was established immediately in the blocks bounded by Franklin and Octavia, Chestnut and Bay Streets. The camp was laid out and constructed under the direction of the army engineers. The government supplied for this purpose 4,000 shelter tents. A number of large manufacturing companies arranged to receive and care for refugees at their respective plants along the eastern shore of the bay. Two thousand seven hundred and fifty persons were accommodated.

Fully 30,000 persons were being fed by the government at the Presidio and North Beach. Provisions were being bountifully supplied to all who made application, and as yet there was no suffering from hunger. Tents were being distributed. More than 10,000 were given, and the authorities intended to continue the distribution so long as the supply lasted.

Barracks were erected in Golden Gate Park to accommodate 15,000 persons.

ORDERS FOR CITY GOVERNMENT.

General Funston issued an order from which the following are extracts:

"Lights are authorized between sunset and 10 P. M. In case lights are burning after this hour, sentinels will investigate quietly and inform the occupants that orders require lights to be extinguished at 10 P. M.

"In houses no fires will be permitted in stove grates, furnaces or other fireplaces having exit through chimney flues, unless the occupants of the house hold a certificate issued by authorized inspectors showing the chimneys in proper condition. Oil stoves may be used.

"All persons, except suspicious characters, will be permitted to pass sentinels without interruption, provided they are orderly and do not destroy, molest or appropriate property not their own.

"The division commander desires to impress upon the troops the importance of temperate action in dealing with the unfortunate people who are suffering from the awful catastrophe that has befallen them. He desires also the assistance of the people, for whom every effort possible is being made. Assistance, food supplies, tentage and blankets are beginning to come in very rapidly, and in a very few days it is believed that sufficient supplies of all kinds will be regularly distributed.

"It is particularly requested that no person permit himself to receive more of any kind of supplies than are absolutely necessary.

"Our greatest danger in the future may be expected from unavoidable unsanitary conditions, and every person is cautioned that to violate in the slightest degree the instructions of the sanitary officers would be a crime that could have no available punishment."

Food was never more plentiful in San Francisco, and the only trouble was its proper distribution. The committee on feeding the hungry reported the most satisfactory progress in the huge task and had fifty-two establishments where the hungry could obtain food. From all points news of approaching relief trains was coming in and already sufficient provisions had accumulated at the Oakland pier to supply the needs of the city for more than a week. Plain food of every description was plentiful and luxuries were beginning to arrive.

There were an abundance of meats for stewing, though all the finer cuts were used at the hospital. Immense cattle trains were rolling northward from the prairies of the southwest and chickens and eggs were coming from nearby towns. The most pressing need was for vegetables.

The condition of the 5,000 persons camped in Jefferson Square was terrible. Not more than five per cent. had an army tent, and makeshifts were constructed of carpets, bed sheets and every imaginable substance. They were inadequate to keep out the heavy rain that fell.

WEAPONS TAKEN AWAY.

Chief of Police Dinan issued an order to police captains instructing them, in view of the carelessness of persons granted the privilege of carrying firearms, to make all persons discontinue carrying weapons. The only government department in the San Francisco Custom House in which work was continued during the day of the fire was that of Surveyor of the Port Woodward. He and his chief deputy, Chauncey M. St. John, were at their desks by 9 o'clock in the morning and remained there all day. The fire crept up toward them from the water front and finally was on all four sides of the building.

Amid the roar of the conflagration, the crash of falling walls, the excitement attending the work of the 150 jackies who saved the building,

their work went on uninterrupted. Inspectors fought their way to the building, reported to St. John and received further orders regarding their work along the water front. It was a severe test, but neither the surveyor, nor his inspectors showed any inclination to abandon their posts.

Freaks of the earthquake and incidents of the disaster were described by refugees who were arriving here from San Francisco at Salt Lake:

"There were ludicrous scenes even in the saddest hours," said L. E. Ryter, a Salt Lake mining man. "I never saw so many parrots, canary birds, mocking birds and pet dogs together in my life. I saw a pet dog on the seat of an automobile, the owner of which would not stop to take in any wounded man on the sidewalk.

"One thing will always remain in my memory. On a pile of bricks, stones and rubbish was thrown the body of a man shot through the heart, and on his chest was pinned a placard: 'Take warning!' It was a most effective way to terrorize those who would steal.

"It was grand to see the spirit of men who had lost fortunes themselves in cheering up the poor ones who had lost things of no great value. 'Why, I lost $200,000,' said one. 'What is your baby carriage to that? Cheer up! It will all come out in the wash.'"

FREAKS OF THE EARTHQUAKE.

Another arrival described freaks of the earthquake. One of the churches on Van Ness Avenue had a mosquelike dome. The building was blown down, all the walls falling away, but the steel structure, invisible at a distance, remained, supporting the dull gray dome, which seemed floating in the air like a balloon. Among the queer sights witnessed by this narrator was a lone woman patiently pushing an upright piano along the pavement a few inches at a time and a woman lovingly embracing a Japanese dog.

Miss Ina G. Bothwell, a student, tells of incidents at Stanford University. A girl was dressing in one of the sorority houses, when the floor gave way. Her companion looked up, saw that she was gone and shrieked: "Where are you, Mary?"

"Oh, I am in the parlor," replied the girl, calmly, as she wriggled out of the heap of plaster and mortar below.

One man, at least, according to Miss Bothwell, missed what would have been the experience of a lifetime, because he did not wake up. Although the fraternity house was almost razed to the ground, this man, whose name she did not learn, slept on, and was still sleeping when they rescued him from the ruins.

J. J. Daly, a wealthy mine owner, escaped with his wife and four children. He left the Charlemagne Hotel in his automobile, but the police made him give it up to carry the wounded. Speaking of his experiences he said:

"The policing of the city was perfect under the circumstances, and I want to give unstinted praise to the chief and his brave men. We finally got over to Oakland, and in a half-starved condition entered a restaurant there. Six of us ate a hearty meal, and the check was only $1.60."

A THRILLING TALE.

With the arrival of the 12.17 train from the West on Monday the first of the San Francisco sufferers passed through Philadelphia. Among them was Frank Du Bois, a real estate dealer, living at 11 Van Ness Avenue, San Francisco. He left Oakland at 6 o'clock on Wednesday, the day of the earthquake. Still bearing the bruises of the knocks he received when thrown from his bed by the shocks, Mr. Van Ness told a thrilling story of the appearance of the stricken city. He said:

"I was in a sound sleep about 5 o'clock last Wednesday morning, when suddenly I was thrown to the floor as if taken around the waist and hurled into space. Jumping to my feet in a dazed condition, I found the floor on which I was standing rocking like a rowboat in the wake of an excursion steamboat. The bed and bureau were dancing around the room in a most astounding manner. I had never been through an earthquake before, and I did not know what the trouble was.

"On endeavoring to open the door I found it jammed tight, and had to take a chair and demolish the door before I could leave the room. In the hallway I found my two children and my brother, panic-stricken, because they could not find their way from the house. Picking up the children, I dashed through the front window, with my brother following.

"When we reached the street we found our neighbors on all sides,

attired only in their night clothes. For the first few moments every one was nearly crazy, the men even worse than the women. Some thought the end of the world had come, and dropped to their knees and offered prayers for their deliverance. Others cursed and stormed and acted like lunatics.

"I left San Francisco for Oakland at 9 o'clock on Wednesday morning, as I had made arrangements to come to New York on a business trip. At that time there did not seem to be any great fear of fire, but as I went through the street I saw hundreds of persons on their way to the hospitals to have their injuries attended. I did not see any dead, and did not realize the extent of the disaster.

"The horror of the tragedy did not strike me until 4 o'clock in the afternoon, when it appeared from Oakland that the whole city of San Francisco was burning. I endeavored to get back to the city to take care of my family, but the police would not allow me to return, so I started East, as I had planned."

The Transcontinental limited had as passengers two survivors of the San Francisco earthquake, Frank Humboldt, a broker, of New York, and Herbert Alwee, a real estate agent, living on Nob Hill, San Francisco.

PANIC IN A STREET CAR.

At the time of the first shock Mr. Alwee was on a cable car passing through Chinatown. He said:

"I was on my way to a train for the East when the first shock came. Coming down from Nob Hill, I took a car on Clay Street about 5 o'clock on Wednesday morning, and when we were just opposite the old Plaza, now known as Portsmouth Square, we felt the first trembling of the earth.

"There was a tremor, as though some one had shaken the car, and when we were looking at each other—there were only eight of us in the car—the second shock came. I was thrown from my seat into the lap of a laborer, who had himself been thrown to the floor of the car. We were all quiet except the conductor, who was kneeling on the rear platform, yelling at the top of his lungs, 'Hell has broken loose!' He repeated that several times, and then he began to pray, several passengers following his lead.

"Several of the old ramshackle buildings of that portion of China-

town lying close about us had already fallen, and most of the other frame buildings were leaning over at an angle of 45 degrees, falling one by one at every moment. From their doors there issued a motley throng of Chinamen, clad only in their queerly figured pajamas, fighting among themselves in fear that one might find a better means of escape than the other. Here and there in the crowd, growing larger and more turbulent every moment, was a small group of painted white women, what we call in 'Frisco 'the white Chinese.' Strange to say, such a group was always accompanied by a mighty Chinese guardian, who hewed a way through the throng for the women in his charge. I saw one of the women go mad from fear, striking out at her own protectors, and then escape from their custody.

WOMEN PRAYED WITH CHINESE.

"In Portsmouth Square an attendant in one of the Joss houses in a nearby street had erected a temporary altar to one of the many deities of the Chinese, and this was for the moment the Mecca for all the faithful. Here there were gathered fully a thousand Chinamen, and among them were a score of the painted women, worshiping at the same pagan shrine with their Chinese masters. And then the new terror that came after the earthquake, the lurid glare of the flames against the sky, the frightful messages of peril seen everywhere about the doomed city."

The new San Francisco that will rise from the ashes of the old was in its first stages of rebuilding. After five days of confusion and almost superhuman effort on the part of citizens of California's metropolis, the great task of sheltering, feeding and otherwise caring for the homeless thousands, complete order was established and attention turned to the future.

Throughout the great business quarter, where the devastation by fire was the most complete, dangerous walls were razed, buildings that had not been disintegrated by fire were inspected with a view of reoccupancy, and ground was cleared for the immediate construction of buildings in which to resume business at the earliest possible time.

Confidence was restored. The assurance of insurance companies, the measures taken by the financial institutions, the prompt and reassuring

words that reached the business men of San Francisco from Eastern financial centres, all these things dispelled the feeling of uncertainty. Property owners had an opportunity to inspect some of their holdings and, in a measure, ascertain what damage had been done.

STEEL BUILDINGS ALMOST INTACT.

The new modern steel buildings were found to be almost intact. In every instance it seemed that the earthquake had not damaged them. The steel frames were in perfect plumb and as strong as ever. Cornices and fancy trimmings fell, but that was all. Even when the fire swept through them only the woodwork was damaged. The Fairmount Hotel, on Nob Hill, will be completed; the Claus Spreckels Buildings on Market and Third Streets will be occupied. The Union Trust Building, at Montgomery and Market Streets, only lost the interior woodwork, and as soon as men put in the lumber it was ready for occupancy. The St. Francis Hotel was in the same category, and the work of renovating the interior was commenced. An inspection of the *Call* Building, at Third and Market Streets, disclosed the fact that several of the floors of the building were in good condition, and could, after slight repairs, be used.

The Monadnock Building, on Market Street, next to the Palace Hotel, was found to be in first-class condition. Even the woodwork in the interior of the building was intact, and the owner announced that within ten days he would be renting offices in this building. The Monadnock is a large structure of steel and brick, almost completed when the fire came.

Three train loads of dynamos, telegraph instruments, Wheatstone machinery, etc., and a dozen Wheatstone operators, in charge of Chief Electrician McKissick, of Chicago, arrived at Oakland Monday night, consigned to the Western Union Telegraph Company. A plant was immediately established at West Oakland, and the congestion of messages was greatly relieved. The Western Union cables to Oakland were tested and found to be in perfect condition, which would indicate that communication between San Francisco and Oakland was restored.

The Postal Company was rapidly instaling its dynamo plants and duplex instruments in Oakland. The officials said that from present indications the headquarters of the company would be at Oakland for a fort-

night at least, possibly longer. The Commercial Cable Company reported that its underground city lines in San Francisco suffered no damage from the earthquake shock.

One fortunate condition still remained with San Francisco. There was an abundance of gold and silver coin available in the vaults of the United States branch mint in the city. The mint had almost completed its coinage for the fiscal year when the earthquake and fire interrupted this operation. Furnaces and grate chimneys were to be ready to start up at an hour's notice if suitable power could be obtained.

A significant indication of the early restoration of law and order and safety was the fact that there was not a soldier or city police officer guarding the many millions of dollars in the vaults of the mint. The soldiers and other guards were dispensed with the first day of the fire. The heavy rains did not weaken the walls left standing in the burned area, according to the Building Commissioner. Menacing walls are dynamited as fast as possible.

MILLIONS IN COIN AVAILABLE.

The national government appropriated $1,500,000 for the relief of the California earthquake sufferers on Monday, the 23d, which sum, added to the $1,000,000 appropriated several days before, brought the total contribution authorized by Congress to $2,500,000. This money was expended under the direction of the Secretary of War.

The first step in the movement towards giving San Francisco all the material she will need to rebuild with, and at the lowest possible price, was taken at Washington, when Representative Gaines, of Tennessee, introduced a bill admitting free of duty all goods, wares or merchandise which may be imported into the United States as gratuitous contributions for relief of the earthquake sufferers, and consigned to the Governor of that State, the Mayor of San Francisco, the Secretary of War or the Secretary of Commerce and Labor.

E. H. Harriman, president of the Union Pacific Railroad Company, sent the following message from Oakland, Cal., to the offices of the railroad company in New York:

"Having gone over the situation in San Francisco, I am deeply im-

pressed with the necessity of uninterrupted forwarding of foodstuffs with which to feed the 200,000 homeless people. The situation is well organized, and the United States Quartermaster's Department is receiving and distributing through its channels and through the various local relief associations all supplies as fast as they arrive; but the fact should be made public in all quarters that it will require continued effort on the part of every one to keep supplies coming. The railroads are, of course, handling all such supplies without charge, and the people must respond to calls for relief."

TO KEEP ACCOUNT OF MONEYS.

In order that the public should have an accounting of how its money was expended and its supplies distributed after the relief work has come to an end, President Roosevelt on Sunday wrote to Miss Mabel T. Boardman, of the Red Cross Committee, requesting that the organization send an expert accountant to San Francisco to keep the accounts. Miss Boardman replied that United States Judge Morrow, president of the California Red Cross branch, would appoint an accountant at once in San Francisco.

President Roosevelt was much concerned over the press reports that the Chinese residents in San Francisco might be overlooked in the distribution of relief. The President communicated with Secretary Taft, with the result that Acting Secretary Oliver sent the following telegram to General Funston at San Francisco:

"Dr. Edward T. Devine, Red Cross, San Francisco.

"According to newspaper reports suffering and destitution liable to become peculiarly great among Chinese. Nothing known of the matter here beyond press reports. At suggestion of the President, I am authorized to say in name of Secretary Taft, president of society, that Red Cross work should be done wholly without regard to persons, and just as much for Chinese as any others. Please see that this is done. Secretary of War will instruct General Funston to co-operate with you in this matter. Have already given to first secretary of Chinese Legation, who has left for San Francisco, a letter to you asking that he be extended all possible assistance in relieving distress of Chinese.

"McGee, Secretary."

"President directs you furnish same shelter and camping facilities to Chinese as to others, and that you co-operate with Red Cross in relieving suffering or destitution among them. Use your own discretion as to whether special camps shall be established for them. Government supplies must be furnished and government protection afforded.

"OLIVER, Acting Secretary of War."

NEWSPAPER COMMENT ON DISASTER.

A prominent newspaper journal made the following comment on the appalling disaster:

"Instantly, as is the sound American habit in great disasters, the work of planning for rebuilding has begun in San Francisco. The insurance companies will furnish the capital. One great realty owner of San Francisco property in the East has announced his intention of at once rebuilding. The fire was still blazing when despatches for steel for construction began to be filed. The new San Francisco, taught by a terrible lesson, will adopt the steel construction which experience has shown resists the earthquake shock and withstands fire.

"The plan of the city and its distribution of quarters will doubtless be revised. The Chinese quarter occupied with all its loathsome reminders of the East, the most valuable of realty in the heart of the business quarter. The tenement quarters, with its frame buildings, was a survival of earlier days. More than one slum, like the 'Barbary coast,' had its evil beginning in days when San Francisco was still a great mining camp.

"In a city as full as San Francisco is of local pride, of personal initiative and of a capacity for efficient organization, the improvement which Baltimore showed after the recent fire in street and building will be outdone on the Pacific Coast. The city is almost debt free, in part because its water supply is in the hands of a company. Its total bonded debt a year ago was only $4,245,100. Its realty valuation is $402,127,261, and its personalty is $122,258,406. If the buildings are gone the realty is still there, and new edifices will replace those shaken by earthquake and consumed by fire. With this sound financial condition, with the plan of the city open to revision and with great possibilities before the city, the next two years are about to see an amazing transformation.

"No past record is to approach the great flood of relief streaming to San Francisco from every quarter. The disaster of the city is the disaster of the land. Its loss is an universal loss and its relief an universal duty. In three days the subscriptions made for Chicago in over a month have been doubled. The close of the week sees the Johnstown relief doubled. Before the current month is over the sum subscribed will have reached $15,000,000, and may run to $20,000,000.

"This vast sum, by the side of which all previous aid for like disasters seems small, is to come from this country alone. President Roosevelt will receive unanimous national approval in refusing the contributions tendered him by two steamships. The American people, prompt to succor all the world, rejoices to show that this crushing and sweeping calamity can be met from its own resources and relieved by the boundless liberality of the citizens of the great Republic. No like spectacle of well-planned, wide-spread and universal relief has ever been witnessed. Congress leads with its appropriations. The great cities are doing their share. Philadelphia, as is its habit, comes forward first in the line with the appropriation of $100,000. The interior and the Pacific Coast are following a like course.

"Great disasters have been followed in the past by depressing accounts of misdirected effort. The National Red Cross, in its operation in the field under the direction of the Secretary of War, gives every prospect of efficient relief, conducted by trained agents, under military supervision. Swept by the two greatest disasters known to cities, San Francisco has instantly reorganized its new life under new conditions.

REHOUSING THE MULTITUDE.

Individual acts of heroism, numerous and bright as they are, stand as nothing by the side of the sobriety, the self-restraint and the order which has marked the vast army of 200,000 suddenly unhoused by this calamity. The grip of order has never been relaxed. After twenty-four hours of short supplies the municipality and the troops together have provided rations. Rehousing the multitude has already begun.

Those who remember the disorder which swept over Chicago after its fire, the difficulty, in spite of a like display of like qualities of restoring order, the challenge raised as to the prompt and necessary acts of General

Sheridan's sentries and the time that elapsed before the reorganization of society was over, can appreciate the advance which San Francisco shows. If this has been for six years past a land of great and colossal disasters, these catastrophes are met with a courage and resolution as great. Experience counts for something, even in these emergencies, and San Francisco, from the hour of the first shock, has shown the stuff of which American communities are made, cheerful, indomitable and self-controlled —always able in the wreck of all things past to create a new order and the orderly supply of the necessities of life for all."

Destructive earthquakes are so infrequent that it is not generally appreciated that seismic shocks are really of almost daily occurrence. Hardly a day passes without an earthquake occurring somewhere in the world. Most of these, fortunately, are mere quivers of the earth crust, and would pass unnoticed had not science invented the seismograph, a most delicate instrument, which records these feeble shocks.

The American continent furnishes almost one-half of the recognized earthquake centers of the world. Excepting for the Caribbean region, these centers where seismic disturbances are frequent and expected lie along the Pacific Coast. Earthquake shocks have been felt at various points along the Atlantic seaboard of the United States, but, excepting the devastating earthquake at Charleston, these have been of slight importance, and have not resulted in great disaster.

AUTHENTIC DATA NEEDED.

Before the student of earthquakes can say a certain district is likely to be free from seismic tremors a great deal more authentic data must be acquired. As it is, all that can be said of any section of the country is that it has or has not been frequently shaken. The cause of the Charleston earthquake, for instance, has not yet been determined, but it is true that in recent years the origin of many earthquakes has been discovered. Many others, however, cannot be accounted for with certainty.

Seismology, like meteorology, is not yet far enough advanced to announce any invariable laws. It had been the opinion that serious earthquakes never occurred on low lands which had a gentle gradient into the sea. The destruction of Charleston, while not nullifying this principle, at

least showed that it was not to be considered as invariable. On the other hand, there are mountainous districts in which earthquakes are of great rarity and in which devastating shocks are unknown in historic times.

The earthquake centers in the three Americas are almost as definitely charted as the islands in the seas. At the same time earthquake districts lying close together will show that seismicity in them arises from totally different causes. One will plainly arise from a well-defined tectonic cause and the other will be unmistakably volcanic in origin. All earthquakes are in general assigned to one or the other of these two sources of origin, but labeling them in this way does not explain fully what happens in the interior of the earth to cause the destructive action at the surface.

In Japan there is a seismological society which already has filled many volumes with valuable transactions, observations, recorded data, etc. Japan is most prolific in earthquakes—almost 1000 are recorded every year in various parts of the empire—consequently it is a profitable field for seismologic research, and the present knowledge on the subject has been very considerably advanced by observations made in the Land of the Rising Sun.

SCIENTIFIC STUDY RECENT.

While earthquakes have been noted for the last 3000 years, they have been made the subject of scientific study for only a comparatively recent time. Many circumstances are responsible for this delay in attempting to collect and collate data in a systematic manner. One of the chief causes was the absence of an instrument to record the movements and duration of the seismic tremors. The invention of the seismograph has made possible the important progress of late years. It records every earthquake, no matter in what part of the world it is central, for every earthquake is felt all over the surface of the earth; but when it is thousands of miles distant the waves are not perceptible, excepting to the delicately balanced instrument designed to respond to the most feeble pulsation.

Another valuable contribution to the science has been the tables of the distribution of seismicity prepared by De Montessus de Ballore. In these tables the observations have been brought down to recent times in those districts in which seismic occurrences have been most frequent

and best observed. They include all earthquakes recorded in historic times, and list a total of 131,292 quakes and 10,499 epicenters, or points of origin. The records, naturally, are incomplete, but sufficient data are given to show that earthquakes are of great frequency, and that practically they occur in every part of the world. The tables also show markedly that certain parts of the world are especially liable to be shaken, while in others seismicity is rare or at least infrequent.

GREAT CIRCLE OF FIRE.

The so-called "great circle of fire" around the Pacific Ocean is found to produce the largest number of recorded earthquakes. In Central California alone there were observed between 1860 and 1897 no fewer than 1096 earthquakes at 113 epicenters. Owari, Japan, is much more frequently shaken, 3356 shocks being recorded at 48 epicenters, or an average frequency of 24.74. The mean average of frequency at Tokio, however, is 92.25, the highest average in the world. It should be remembered that these are seismologic observations, made of those shocks which were perceptible to the human senses without the aid of instruments.

The study of the geographical distribution of earthquake centers brings out some significant facts, but at the same time it fails to account satisfactorily for some phenomena observed. As has been remarked, earthquakes are divisible into two classes, volcanic and tectonic, according to their causes. It is not always possible, however, to declare with confidence to which of these classes a particular quake should be assigned.

One of the significant facts whenever the question of class arises is the situation of the epicenter with respect to an active or recently extinct volcano. Close proximity to a volcano raises a presumption that the quake is of volcanic origin. Tectonic quakes also have certain characteristics which, though not always exclusively exhibited by them, are much more common with them than with volcanic quakes, and *vice versa.*

There is in Japan a remarkable absence of any tendency of earthquakes to associate themselves with volcanoes. Most Japanese earthquakes originate at sea, and their vibrations on land indicate that they have traveled a considerable distance, and that the disturbance which originated them must have involved a much higher aggregate of energy than is exerted

even in the most forcible volcanic quakes. The great Mino-Owari quake of 1891 originated on land, and its obvious cause, clearly disclosed in the great dislocation, proves its tectonic nature. The majority of the Japanese earthquakes, however, originate on that great slope of the sea-bottom which leads to the Tuscarora Deep.

Around the supposed "fiery great circle," which surrounds the Pacific from Cape Horn to Bering Sea, thence down the eastern archipelago of Asia to the Dutch East Indies, are a considerable number of districts of high seismicity, separated by wide intervals of low seismicity. They are situated upon the most pronounced slopes leading from land to sea-bottom. Between Japan and Luzon, in each of which there is a fairly high seismicity, there is no evidence of any exceptional degree of earthquake frequency.

OPINION OF AN EXPERT.

Major Clarence E. Dutton, U. S. A., who is one of the most esteemed authorities on seismology, places no belief in the "Circle of Fire." He says there is no such circle, although admitting the so-called circle is outlined by many volcanoes and by many districts of marked seismicity. "There is," he states in his recent volume on "Earthquakes in the Light of New Seismology," "an inconsiderable amount of seismic action along the Kurile chain and the Kamchatka coast and along the western Aleutian chain. It appears to increase in the eastern Aleutians. We should expect to find along this island barrier of Bering Sea indications of volcanic rather than tectonic disturbances, for active volcanoes are numerous there. On the contrary, most of the well-defined quakes from that quarter are clearly of the tectonic class, and have been made known to us in their character of world-shakers by the records of horizontal pendulums in Canada, Europe, and even at their antipodes in South Africa.

"In truth, the profound depths of the ocean just off the eastern part of the Aleutian chain is one of the great breeding grounds of world-shakers. A rather small basin in the ocean bottom has here a depth of nearly 4000 fathoms, and the descent to it is by a long and strong gradient. Between the Alaska-Aleutian field and the coast of California earthquakes are infrequent, but from Cape Mendocino southward the seismicity increases again."

According to the catalogue of recorded quakes in California from 1769 to 1896, made by Prof. E. S. Holden, ten earthquakes of high intensity were felt in that State during the nineteenth century. From 1850 to 1886, 254 quakes in San Francisco are recorded.

CALIFORNIA INDICATIONS.

Of the California quakes, Major Dutton says they, as a class, suggest a tectonic origin. "High intensities are not common," he declares. "The lighter intensities are felt over considerable areas, which suggest great depth of focus. The seismographic traces show considerable length of period and well-marked separation between the short preliminary tremors and longer waves, which is indicative of considerable distance traveled by the vibrations between the centrum and the recording station. The deep foci, the long periods, the absence of small tremors, the considerable areas over which light vibrations are felt are indicative of tectonic rather than volcanic origin.

"Proceeding southward along the Pacific Coast, no marked development of seismic activity appears until we reach southern Mexico, in the State of Colima. Occasional reports are made of quakes in the vicinity of the great volcano Colima, and the City of Mexico has been visited by a few shocks of moderate intensity, and by occasional light tremors. But the developments of seismic action are not great. In the State of Oaxaca, however, there is a sudden and great increase of seismicity. It occurs in a long and rather narrow belt, extending parallel to the coast, reaching into Guatemala and through the entire length of the Central American States to the Isthmus of Panama."

The Central American and South Mexican seismic regions indicate a volcanic origin. These regions are famous for their volcanoes, which are more numerous and closely adjacent than anywhere else in the world. Throughout the 1500 miles of volcanic coast line earthquakes have always been abundant and often highly destructive. In 772 quakes of which records have been made, it was found that their epicenters occurred in close proximity to the volcanoes, and never more than four or five miles from them. It is a remarkable fact that none of the notable quakes observed in this district suggests a tectonic origin.

Following the coast line into South America, two seismic regions are encountered at Panama, both of them at a great distance. One is in Venezuela, far to the eastward; the other in Ecuador, far to the southward. "Our knowledge of earthquakes in the Andes," continues Major Dutton, "is usually too insufficient in detail to enable us to form a very definite opinion as to their nature and class. Some of them originate in places which are not far distant from volcanoes, but whether near enough to create the presumption that they are really associated with them is not always known. On the other hand, many Andean quakes display the tectonic character so clearly that their origin is equally free from doubt.

Both classes, however, are abundant. From a point about 250 miles north of Callao to beyond Valdivia, in Chile, the South American coast has been subject to earthquakes of the greatest energy. Sometimes they have originated upon the sea-bottom. In these cases great sea waves have rolled in upon the coast, with disastrous effect.

"The most notable of the several districts in South America," says Major Dutton, "whether they be regarded as interdependent or not, is the southern one, occupying the sea-bottom between the Island of San Juan Fernandez and the Chilean coast between latitude 26 and 39. This district is remarkable for the number of quakes of the highest order of magnitude which have originated there."

Australia is little disturbed by earthquakes, but its neighbor, New Zealand, has been visited by 800 in forty-three years. The Dutch East Indies are, as is well known, a region of both volcanoes and earthquakes.

ALONG THE ANDEAN SYSTEM.

To refer to the Western Hemisphere again, it has been recognized by various geologists that the Windward and Leeward Islands of the West Indies are part of the continuation of a spur of the Andes. The seismic belt which begins in Venezuela continues along the reefs and basins into these islands. The descent of the Andean system is rapid to the coast of La Guayra, and thence to the depths of the Caribbean. Throughout the Windward and Leeward Islands the frequency of quakes is high, but the intensity is seldom great. About forty miles north of the Island of St. Thomas is the deepest abyss in the Atlantic. San Domingo, Jamaica,

the eastern part of Cuba and Porto Rico are frequently shaken, and their seismicity may be put, according to the authority quoted, into relation with the fact that the sea-bottom in the vicinity of those islands is one of the most rugged and highly diversified in its profiles of any part of the earth.

Both the Homœopathic Medical Society and the Philadelphia County Medical Society took steps toward raising funds for the relief of physicians who suffered in the San Francisco disaster. At the meeting of the former it was decided to send a letter to every practitioner of that school of medicine in the city, asking for contributions. The city was divided into districts and the members of the society canvassed them to collect the money.

The Philadelphia County Medical Society passed resolutions in which the society itself contributed $200 from its treasury for the relief of physicians who were losers in the catastrophe.

Other societies and organizations all over the country took similar action and there was what might be called a concerted movement to care for the immense army of sufferers whose desperate straits appealed to every charitable heart.

CHAPTER XV.

HARROWING INCIDENTS RELATED BY SURVIVORS.

SLOWLY through the week there was unfolded the dreadful story of the earthquake, of the hard, merciless punishment of the innocent. The whole world sympathized with the thousands of unhappy men and women, the victims of the great power that lies half chained beneath us.

It is a giant of dreadful force, slumbering fitfully beneath the thin crust of earth upon which we live. Thousands of centuries ago the cooling of our earth's surface imprisoned in its center the great power that occasionally frightens us now. The slightest movement of this hidden giant, the slightest shaking of the vast force or shifting of the fiery, fluid heart of the earth, means instant death to the little creatures living at the danger point.

No wonder the Chinese, from the traditions of centuries, have built up a belief in a huge dragon, the earth's dragon, that sleeps underground. To this day the Empress of China refuses permission to dig mines, and even to build railroads, for fear of irritating the earth's dragon. This superstition of an old nation is born of the rumbling, crashing and deaths that frightened the Chinese in earthquakes centuries ago.

It seems a very real and a very natural superstition to-day as we contemplate the havoc worked by a few seconds' agitation of the monster power sleeping beneath our feet. The human mind would strive in vain to form any estimate of the power of the blow that fell upon the beautiful city of San Francisco. It is totally beyond us to imagine what happens in nature, when there is a shifting of the solid formation of a globe of matter eight thousand miles in diameter. A mosquito on the bow of the greatest battleship is an elephant in size compared with a man on the earth's surface. When we think of the convulsions that pushed into the air the huge and splendid mountains of rock, crushing the "rock folds" together, raising continents from the sea's bottom, we can realize faintly how mild in comparison are the demonstrations of the tired monster to-day.

But mild as they are, comparatively, they have plunged a beautiful city and a brave people into sorrow and poverty. They fill with alarm all the inhabitants of this land and of the world. They emphasize painfully our feebleness, our helplessness. And they emphasize marvelously our absolute dependence upon that cosmic balance which we so often forget, and to which we owe so much.

In the midst of the national sorrow, universal anxiety, we should not forget the marvelous stability and precision that protect such tiny creatures as ourselves on this gigantic, whirling sphere. Our imagination should be stirred into fresh efforts, we should view with increased awe, with the most profound reverence, the extraordinary and glorious whole of which we are a dependent, humble, feeble part. As for those that dwell in the regions of devastation, no word can express the sympathy that is felt for them, nor the force of the blow that has fallen upon them. Utterly defenseless, utterly without preparation or warning, their homes, their hopes and plans, their beautiful city, was struck out of existence.

"From going to and fro in the earth, and from walking up and down in it." Thus Satan answers, in the first chapter of the marvelous book of Job, when questioned as to his doings.

COSTLY BUILDINGS LAID IN RUINS.

And it would seem that the great ruler of Iniquity, in his going to and fro, laid a heavy foot upon our shore of the Pacific. Everywhere churches, houses, schools, hospitals and prisons were alike laid in ruin. Wherever there was property fires were blazing. Every dreadful curse seemed to have fallen upon human beings that deserved no such fate.

All the demons that could torment the soul were at work. Thirst, fire, hunger, darkness, disease, terror and inevitable poverty. These are the curses that afflicted hundreds of thousands of our brothers and sisters in the West. Truly, the gates of death have been opened unto them, and they have "seen the doors of the Shadow of Death."

The wounds that can be healed will be healed. Thousands of Americans have gladly helped those upon whom the heavy sorrow fell. The government of States and of the nation co-operated with the brave men of California in meeting an affliction, the greatest in our history outside

or war. But, unhappily, a great part of the suffering and of the loss is irreparable. The bodies that lay mangled, burned and crushed could not be revived. They were cut off.

The labor, the effort and the ambition represented in one of the world's thriving, beautiful cities all went for naught. They were waste and loss. The brave, patient work of half a century was gone. The efforts, the lifetime work of tens of thousands of fathers and of mothers was swept away forever. Thousands upon thousands must begin the world again with naked hands, handicapped by age, by a blow as severe as it is undeserved.

The people of the nation united in such a demonstration of sympathy, charity and helpfulness as proved our worthiness to compete with the great power of nature that we must subdue ultimately. Our human courage and charity should now prove that our characters are worthy the control of this great planet, a driving wheel that overawes us as it now supports us, but that one day will be subdued, obedient, a comfortable and safe home for thousands upon thousands of millions of truly civilized, educated and competent men.

TRAGEDY AND COMEDY COMBINED.

The tragedies and comedies of the San Francisco disaster were related in vivid language by Mmes. Olives Fremstad and Josephine Jacoby. the first divas of the Metropolitan Opera Company to arrive in New York. While Mme. Fremstad saw the darker side of the tragic epic of San Francisco's ruin, Mme. Jacoby, while appreciating the tragedy, related the humors of her immediate experiences and those of the grat opera troup.

"I am here at last, thank Heaven," said Mme. Jacoby, after undergoing an experience so terrible and at times so humorous. I was awakened at 5.13 o'clock on Wednesday morning by being tossed out of my bed, on the third floor of the Palace Hotel. The bed was rocking to and fro, and the ceiling never seemed to stay in one place. The rocking of the hotel was accompanied by a terrible crunching noise, and I could hear the roar and crash of falling buildings. I ran out into the hallway in my nightgown and then barefooted into the street. Everywhere there was confusion, women screaming and men trying to reassure them.

"And poor Caruso! He was simply dumb from fright. He came rushing to the street and sat as one dazed on a little trunk. Other members of the company came out on the street, and then we all went back into the hotel again and were given coffee. Just as we were packing our trunks the telephones rang, and we again rushed from the hotel. I only had time to put on these slippers, which I wore in singing Carmen the night before, this suit, fur wrap and winter's hat!

"When we all got outside, Hertz began taking an inventory of our people. At about 9 o'clock somebody said, 'Where's Fred Rullman?' No one seemed to know, and after making vain inquiries, it was suggested that he might possibly be in his room. Hertz rushed up to the third floor and banged on Rullman's door. 'Who's there?' responded a voice.

"'It's I, Hertz! Great Heaven, man, don't you know that here has been an earthquake, and that the town is burning up?'

"Would you believe it, we had the greatest difficulty in waking up the only man who slept through that terrible earthquake?

"Plancon appeared when we were warned to leave the hotel, attired in top hat, frock clothes and with his inevitable boutonniere. His sangfroid was marvelous. When we had all gathered together we rushed off toward Union Square, with the city ablaze around us. We saw huge rents in the earth, and I felt all the time as if the earth would open up and swallow us.

"The last I saw of poor, speechless Caruso was when he was driven off on top of a loaded truck toward Golden Gate Park. You see, the earthquake had a terrible effect on him, considering the fact that he had just promised to sing at a benefit for his beloved Naples, on account of the Vesuvius disaster.

A NIGHT OF FEARFUL HORRORS.

"And oh, that terrible night that followed! Weed, my maid and I caught snatches of sleep on a porch on the side of the hill, where we could see the red glare of the fire below us. That night Hertz, Goritz, Campanari, Plancon and a number of the women of the company drove up to the sand hills and slept here. The next morning the wagon in which Hertz had been sleeping had been moved to a place in the grounds of the Zoo, and he was awakened by the roaring of the lions and tigers.

"And Nathan Franko! The little man must be running yet. When last seen he was disappearing in the direction of the Rocky Mountains! I understand he is now on his way to New York. Mme. Homer had to leave the hotel so suddenly that she was forced to wear a suit of her husband's clothes.

"Early Thursday morning our little party started for the Oakland ferry. The sun had arisen like a red-hot cannon ball. I shall never forget its color. It was a cardinal red, and across it floated yellow vapors. Down in the central district of the city the buildings lay either overthrown or with their steel frames alone remaining. The fire was sweeping over Nob Hill and residential districts. We finally found our way to the ferry and were pushed on an overcrowded ferryboat and taken to Oakland, where we took the Overland Limited. At Chicago we went to the Auditorium, where we were made much of, as we were the first people who had arrived from the scene of the disaster."

Mme. Fremstad said:

"The scenes were so terrible that they baffle description. It was like Dante's Inferno. I was awakened by being pitched out of my bed, in the St. Dunstan Hotel, which was far removed from the original area of the first day's fire, but the earthquake shock was one that can never be forgotten. You asked me whom I saw in the hotel? I do not know. I remember rushing up to the third floor and taking out an invalid woman. We all sat out on the street then, waiting, waiting, as if the end of the world was at hand. At about noon I was fortunate enough to secure a wagon, and, with my trunks, I was taken to the ferry.

ANTICS OF THE CHINAMEN.

"On the way we passed through the Chinese quarter. We saw men with their blouses afire, their faces seared and blackened by flames, rushing from buildings that were toppling over. Others, with blood-stained faces, ran shrieking from their shattered dwellings. Women, with their children clasped to their breasts, their white skin showing through the thin night dresses, ran before us and were swallowed up in the black smoke. The terrors grew as we progressed. I shall never get over it. I am ill from it now.

"Hundreds of men and women were without anything but night-clothes. I saw a man in his underwear marching grimly ahead with a phonograph under his arm, a woman with a cage of birds, others with parrots, dogs, children, bundles and other things they held dear. Sick and injured, stretched on mattresses, were dragged foot by foot.

"Just after arriving at Oakland the second earthquake shock came. I was standing near a little colored boy, and I clutched him and cried, 'Save me!' The lad looked at me and answered bravely, 'I would, missus, but I caint. Earthquakes caint be interfered with.' I saw a railroad train at the station and I asked the conductor where it was going. He told me to Ogden, and I got aboard. I lost my costumes, which were uninsured, but saved my jewels and personal effects."

Pie and ginger beer formed the diet of Mr. and Mrs. Henry Wark and their daughter, Eleanor, up to the time they were able to board a train for the East following the San Francisco earthquake. The Warks reached Philadelphia at 5 o'clock Tuesday morning, and told of their experiences, amusing as well as distressing, during their struggle to get out of the burning city.

LAID IN A STOCK OF PROVISIONS.

"When we ran from the Palace Hotel at the first moments of the terrible disaster and started to make our way to the higher ground, I had an eye to the future," said Mr. Wark. "I had a small leather grip with me and I stuffed it full of pies which I bought in a little restaurant. They were the only food in sight. Later I purchased several bottles of ginger beer, so while hundreds about us were suffering in the next twenty-four hours for want of food and drink, we had plenty of both. I never knew pie was so wholesome.

"We arrived in San Francisco a week before the disaster," said Mr. Wark. "My object in going there was partly to establish a branch house. I started it all right, but the building and its contents are now a heap of ashes. We stayed at the Palace Hotel, our rooms being on the second floor. When we entered the hotel on the day of our arrival, I was struck by its magnificence. Rising fifteen or sixteen stories from the pavement and covering a large part of a city block, with every luxurious appoint-

ment known to the best modern hotels, it was a splendid structure. In the center was a beautiful open court, with fountains, singing birds and fragrant with the flowers for which California is noted.

"At a quarter past 5 on Wednesday morning we were awakened by the first shock of the earthquake. The whole magnificent building was shaking just as a monkey would shake a parrot cage. A shower of plaster almost buried us in our beds. My wife and daughter stumbled down the stairs panic-stricken. They were in their night clothing, and I followed with but little more in the way of attire. After the shocks had passed I made my way back to our rooms, and hastily donning more clothing, took down, as near as I could estimate, complete apparel for the women. How well I succeeded may be judged from my daughter's remark that she reached home half-dressed.

FRANTIC EFFORTS TO ESCAPE.

"After buying the pies and the ginger beer, we picked our way through the streets amid the smoke from scores of fires, climbing over the debris which covered the ground. At 10 o'clock we reached a high hill at the southeastern part of the city and stayed there until 10 o'clock Wednesday night, when we were driven to the outskirts by the approaching flames. We spent the night on a sand bank wrapped in two blankets, which I had managed to secure from a woman who seemed to have saved blankets and nothing else from her home. Thursday morning we walked by a circuitous route to the water front and proceeded northward to the Market Street ferry, and were among the first to get out of San Francisco."

This was the third devastating fire which Mr. Wark had passed through. He lived in Portland, Me., at the time of its destruction in 1866, and was in Boston in 1872 when that city was almost wiped out by a conflagration.

That three men were shot to death on a blazing roof in San Francisco to keep them from being burned alive is solemnly asserted by Max Fast, a garment worker, who arrived at Salt Lake City.

"When the fire caught the Windsor Hotel, at Fifth and Market," said Mr. Fast, "there were three men on the roof, and it was impossible

to get them down. Rather than see the crazed men fall in with the roof and be roasted alive the military officer directed his men to shoot them, which they did in the presence of 5000 people. I saw great stones fall on three men near the City Hall, crushing the life out of them.

"In Union Square I stood beside a woman who died actually from fright and thirst. Her last request was for water, and we had none to give her. At Jefferson Square I saw a fatal clash between the military and the police. A policeman ordered a soldier to take up a dead body to put it in the wagon and the soldier ordered the policeman to do it. Words followed, and the soldier shot the policeman dead."

John Cashnear, an old soldier from Spear Fish, S. D., saw the military shoot a negro near the City Hall. The negro had been robbing the corpse of a woman, and to get a ring from her swollen finger cut the finger off.

"The sentry on duty near Van Ness Avenue," added Mr. Cashnear, "ordered a friend of mine who was entering his home to come out of there, as it was about to be dynamited. My friend waved his hand back toward the soldier, saying, 'This is my house and I have a right to go in.' The soldier instantly killed him.

"On the other hand, I want to say that the soldiers were generally kind and helpful, and deplored these hasty actions of their companions just as much as we did."

AGNEWS ASYLUM DISASTER.

Nothing could be more terrible than the calamity at Agnews Asylum, near San Jose, as described by R. L. Drinkwater, of Denver. He fled to San Jose from San Francisco, only to find that he had gone from bad to worse. He said:

"We went to Agnews, where we had a friend, and found the asylum in ruins and 200 demented creatures buried there. It was a sight to transfix one with horror to see scores of mad men and women strapped to trees all over the grounds, crying, shrieking and cursing. Ordinarily troublesome in their way, the excitement of the falling building made them mad indeed, and their uncanny looks and fiery eyes were terrible to behold. Nothing could be done for them, as there was no place to put

them, and every sane man, woman and child available was digging to release the other unfortunates buried in the ruins.

"Oh, such cries as came seemingly from the bowels of the earth! 'The devils have got me; let me out!' 'I am the king; you cannot kill me!' 'I want my supper. I want my dinner!' Just as the vagary seized them they called out their disordered thoughts before they even guessed their true condition."

GHASTLY TALE OF GHOULS.

But most ghastly of all is the statement by Willis Ames, a Salt Lake man, who escaped to Los Angeles. He said:

"While I was walking about the streets I saw man after man shot down by the troops. Most of these were ghouls. One man made the trooper believe that one of the dead bodies lying on a pile of rocks was his mother, and he was permitted to go up to the body. Apparently overcome by grief, he threw himself across the corpse. In another instant the soldiers discovered that he was chewing the diamond earrings from the ears of the dead woman.

" 'Here is where you get what is coming to you,' said one of the soldiers, and with that he put a bullet through the ghoul. The diamonds were found in the man's mouth afterward."

Already the beggars were seeking to profit by the misfortunes of San Francisco, and two men arrested while begging in the character of refugees were proved impostors.

[The "soldiers" referred to were undoubtedly militiamen. All reports concurred in the statement that they were reckless, while the United States troops seemed at no time to have failed in discretion or good conduct.]

Following the rain which fell Sunday night and Monday morning, which greatly intensified the misery and suffering of the homeless, Tuesday night was one of comparative comfort and of greatly improved conditions.

The night was clear, warm and balmy, and there was less suffering among the thousands of refugees camping under the blue canopy than at any time since the day of the terrible disaster.

Tuesday afternoon wagon loads of quilts and blankets were distributed among those who had suffered intensely from the cold and ex-

posure while sleeping in the open. Other wagons loaded with tents wended their way through the crowded parks and replaced many improvised shelters, which had afforded little or no protection against the rain and chill winds. As a result, there were but few complaints of suffering. While the heavy rain for the time being added much to the misery of the homeless, it did much toward improving sanitary conditions throughout the city.

At 10.40 Monday night an earthquake shock was felt throughout the city, and momentarily created some alarm among the people, still unnerved and overwrought from their recent experience. No damage was caused, but in some instances persons living in houses ran out badly frightened and called upon the sentries and guards to help carry out clothing and other effects. The soldiers assured them that there was no danger. This new shock stimulated the exodus of refugees, many leaving for Oakland and other California towns.

DYNAMITING THE RUIN.

The general conditions in the city were improving rapidly. Hundreds of men were placed at work clearing the streets, and the dynamiting of the tottering walls which were left standing by the fire and endangered life was continued. The Spring Valley Water Company had about 1000 men at work repairing and replacing broken water mains, and many portions of the residence section were abundantly supplied with water.

No trace of Count de la Rocca, the French Consul, had yet been found. It was feared that he had lost his life in the fire. Many merchants were making arrangements for clearing the ruins of their buildings as rapidly as men could be secured, preparatory to commencing building operations. The situation was constantly growing more cheerful.

Eighty men of the Beneficial Signal Corps arrived and were at work restoring the Government telephone and telegraph communications. The Home Telephone Company, which had been given a franchise, soon began work on its telephone system. The distribution of supplies continued in an orderly manner, and there was no shortage of food.

"Say to the people of California, of the United States and of the world that there is no epidemic in San Francisco and no danger of one.

If we were not absolutely free from contagious diseases, we at least have fewer cases than we have under the circumstances any right to expect. Indeed, we have at this moment fewer cases of such disease than we had a month ago, and there is nothing in the present condition of affairs that would lead us as medical men to fear an outbreak. The sanitation of the city is absolutely under control."

This statement was made by Dr. J. W. Ward, chairman of the Health Committee, Tuesday morning.

Three hundred plumbers, under the direction of the Board of Health, were at work in all sections of the city. They were confining their efforts solely to sewers and water pipes. The broken mains in the business districts were being repaired and the outlets closed. In the unburned residence section the sewers were being flushed and cleaned, and water pipes set in order as fast as possible.

RAILROAD TO HELP CLEAR TOWN.

As a welcome relief to the officials and citizens of San Francisco who looked upon the ruins of the city and upon the monstrous piles of bricks and stone and twisted iron that were once their homes and places of business, was the announcement that the Southern Pacific Railway would aid in the work of tearing away the debris. The railroad officials were ready to build a track through the heart of the devastated city from Harrison Street to the bay, and to run their flat cars in for the wreckage that must be removed before new buildings could arise and normal conditions be restored. In this great work it was announced that between 3000 and 4000 men would be employed. The railroads would carry the debris wherever the authorities wanted it taken, and by so doing would make possible the performance of the enormous task that had been terrifying to those who looked forward to it with the knowledge that it must be done, however tremendous.

E. H. Harriman, president of the Southern Pacific Company, was in San Francisco to inaugurate the work and to see that it was faithfully performed, if the suggestion of the railroad men met with favor at the hands of the city officials. At the meeting of bankers Mr. Harriman said that he would do all in his power and work with every resource at his

command for the rebuilding of San Francisco and the preservation of the city's good name. His remarks to the bankers bolstered their hopes and gave them new courage by contradicting, as it were, the rumors for several days prevalent that the railroad offices and interests would all be permanently removed to Oakland.

Temporary structures were erected in Golden Gate Park for the housing of 40,000 persons. This work was commenced Tuesday morning by the Shelter Committee, and the homeless, who had been sleeping out of doors for nearly a week, were moved into comfortable quarters. About the same time a supply of blankets and bedding was received, and these were taken to the park. At the same time the committee was sending as many of the refugees as possible to interior points.

The seizure of all vacant houses in the unburned district was still under way. Many vacant flats were taken, and the homeless were housed and the sick found good accommodations. A committee of architects was sent out to examine churches and other buildings, including schoolhouses, with a view of turning them into living rooms for the homeless.

FOOD COMING IN FAST.

Supplies of food were coming in rapidly from outside points, and were being centralized in the freight sheds and warehouses still standing. A corps of shipping clerks was placed in charge of these depots, and every ounce of food was checked. With the assistance of Michael Casey, president of the Teamsters' Union, the Food Committee succeeded in systematizing the distribution. They took possession of all the large trucks and teams, which were utilized in hauling supplies to the forty odd subdepots throughout the city. This placed the transportation facilities in excellent shape, and made it possible to deliver supplies as quickly as they came.

The city was laid off in districts covering areas of four blocks. The subcommittees in these districts regulated the supply of food furnished to the families living within their boundaries. In the confusion attending the earlier distributions food was given out in lavish quantities in many instances, and the committees were to see that the proper economy was observed.

CHAPTER XVI.

North American Volcanoes.—Famous Mount Shasta.—Northern Arizona.—Volcanic Glass.—Craters on the Pacific Coast.

A ZONE of mountains extends along the whole western flank of the American continent, from the northern to the southern extremity. This, from Alaska to Terra del Fuego, is associated with volcanoes, though the vents are only locally active, and in the majority of cases the craters are either ruinous or have disappeared. In the extreme north, a volcanic belt extends from the head of Cook's Inlet on the east through Alaska and over the Aleutian Isles towards the district already described. The higher mountains, however, so far as is at present known, are not volcanic —Mount St. Elias, about 18,000 feet, certainly is not.

The same is probably true of its yet more lofty neighbor, Mount Logan, and the other summits near the frontier of British and United States territory; the Alaska coast also, which forms a fringe to this region, seems to be free from volcanoes, and the same is true of South-eastern Alaska and its islands, with the exception of Mount Edgecumbe, an insular volcano which is reported to be a basaltic crater about 2855 feet high, and to have been active in 1796. Eruptions are said to have occurred from Mount Calder and other summits on Prince of Wales Island at a slightly earlier date; but these, as Professor I. C. Russell informs us, are as yet very imperfectly known.

The most conspicuous and best-marked belt begins at Cook's Inlet on the east, and extends through the Alaskan promontory to the Aleutian Islands. It is about a thousand miles long, but generally less than forty miles broad. In fact, every volcano in it which is known to have been active in historic times can be included between two lines on the map of Alaska, twenty-five miles apart. Craters in good preservation are numerous, and active vents not few, one of which has been alreadynoticed. They occur

either close to the sea on the southern border of the mainland or on islands.

To this statement as to the geographical distribution one exception is known; some small cones, also of basalt, occur near St. Michael on the coast of Behring Sea, about seventy miles north of the mouth of the Yukon River; but there may be others, for at present not much of Alaska has been carefully investigated by qualified observers. On Copper River, some two hundred miles to the northeast of Cook's Inlet, and thus apparently insulated from the Aleutian belt, rises Mount Wrangel, a lofty volcano, which was in eruption in 1819 and is still steaming, and others of the neighboring mountains may have the same origin.

On the western shore also of this inlet are two fine volcanic peaks, Redoute and Iliamna, reported to be about 11,000 and 12,000 feet high. The latter is generally steaming, and a few years ago discharged such a quantity of dust and lapilli that the forests were killed over hundreds of square miles on the adjacent lowlands.

VOLCANOES OF ALASKA.

From this district to Central America no active vents exist, though they were once plentiful. In the Canadian territory to the south and east of United States Alaska very little is at present known of its volcanic history. There are lava sheets about the Fraser River of enormous extent, but Dr. G. M. Dawson did not discover here any distinct traces of craters, so that very probably this portion of the American continent may be compared with the northern side of the Atlantic basin, where discharges anciently occurred from Antrim at least as far as Iceland, but now continue only in the latter region.

The Columbia lavas, vast sheets of basalt, have been already mentioned; but here, as in the Fraser River district, cinder cones and craters are wanting, and the eruptions probably date from about the middle of the Tertiary era. They lie to the east of the Cascade Mountains, in which volcanoes have certainly existed, but whether any retain their craters does not seem to be as yet ascertained. There is a tradition that Mount Baker, a fine peak to the west of

the main chain and in the northern part of the district (near Puget Sound), broke out in 1843, but on this point Professor Russell is doubtful.

Mount Rainier, however, a superb peak, not only from its elevation, 14,525 feet, but also because it rises practically from sea-level, still emits some steam. The highest part is a cone built up within the shattered ring of a much older crater, and the materials appear to be basaltic. Mount St. Helens (9,750 feet), also detached from the main mass, is said to have been in eruption in 1841-42, and fumaroles still exist on the slopes. Mount Adams (9,570 feet), farther south and rather east of the main range, apparently retains a crater.

On the crest of the Cascade Mountains, in Northwestern Oregon, Mount Hood rises to a height of 11,225 feet, and is noted for the beauty of its outline. Portions only of the wall of its summit crater now remain, but there are still fumaroles at considerable elevations on the northeast and the south sides. Mount Jefferson (10,200 feet) and the Three Sisters, a little farther south, in the Cascade range, are the sites of ancient volcanoes; but their craters apparently have perished, and to the south of these come others of less elevation, which for the most part retain craters either at their summits or on their flanks, the most important of them being Crater Lake or Mount Mazama, which has been already described.

SUMMIT CRATER OF SHASTA.

Yet farther south comes the noted mass of Mount Shasta, rising to a height of 14,350 feet. The summit crater is ruinous, and the slopes are scarred with ravines; but lava streams have flowed down its flank since the Glacial epoch, and a distinct subsidiary crater remains on a lower summit called Shastina. Farther south comes a volcanic district named Lassen's Peak from its principal summit, which rises to an elevation of 10,437 feet. This is crossed from northwest to southeast by a belt of volcanic cones about fifty miles long by twenty-five miles wide; one of them, Cinder Cone by name, being remarkably well preserved.

The crater, as illustrated by Professor Russell, is a double one, and there were two distinct periods of eruption. In the earlier a quantity of ash was ejected and the cinder cone itself was formed. Then there was a pause long enough to allow ten feet of diatomaceous earth to accumulate on the bed of an adjacent lake, and after that came the quiet effusion of a large sheet of lava.

East of the Sierra Nevada, on the area once occupied by a great sheet of water now spoken of as Lake Lahontan, are two ancient craters filled with alkaline water. The greater, which has an area of about 268 acres, only rises some eighty feet above the level of the surrounding country, so that it resembles, though on a larger scale, such a crater as the Pulvermaar in the Eifel. Geological evidence shows that these were active during the existence of Lake Lahontan, and that before they ceased it had already begun to dry up.

POURING OUT LAVA STREAMS.

In the Mono valley, also east of the Sierra Nevada, but farther south, and near to the lake of the same name, are a number of craters, some not much elevated above the surrounding country, but others rising to over 2000 feet, with lava streams and fumaroles. The materials apparently consist of basalts and varieties of andesite; but the Mono craters, as the line of higher cones is called, have ejected rhyolite and even obsidian. Professor Russell remarks that those cones (some of which have lost their craters), though forming an isolated group, are really a portion of a much more extended series of recent eruptions, which follow the general course of the great belt of branching faults by which the eastern face of the Sierra Nevada has been determined.

The fact that, as a rule, the central cones are the less perfectly preserved and are the older, shows that "the volcanic energy early in the history of the range evidently found an avenue of escape where [they] now stand, and when the conduits of these craters became clogged newer craters were formed, both to the north and south, along the same line or belt of fracture."

To the west of the Wahsatch Mountains, in the inland basin of Utah, and on the area once occupied by the great sheet of water designated Lake Bonneville, are the Ice Spring Craters, a group of low craters, three of which are very well defined, though they are breached by streams of basaltic lava, which covers an area of over twelve square miles. Other craters occur in the district, some being older and some newer than Lake Bonneville, while others were active during its existence.

In northern Arizona the San Francisco Mountains are volcanic. The higher summits, which rise to a mean elevation of 12,562 feet above the sea and about 5700 above the general level of the surrounding table-land, consists largely of trachytic lavas and have lost their craters; but around them are numerous small craters of basaltic scoria, which often are well preserved and are associated with flows of the same rock. Some of these have been breached by the lava, which has welled up in their interior and has escaped exactly as was described by Scrope in his book on The Volcanoes of Central France. In one, however, a lake is sheltered.

FAR-FAMED YELLOWSTONE PARK.

Just east of the crest of the Rocky Monutains, and in the northwest corner of the State of Wyoming, is the far-famed volcanic district of the Yellowstone Park and its neighborhood. Craters apparently are not common in this region, but the great flows of obsidian attracted much attention from geologists. This volcanic glass is associated with pumice, the rocks generally being trachytes, usually rich in silica. The vents are now extinct, unless a mud volcano be regarded as an exception; but the hot springs and geysers to which the Park owes its world-wide fame show that a high temperature still prevails, probably at no great depth below the surface.

The vast flows of basalt in the valleys draining to the Snake River in Idaho, to which reference has already been made, are on the western slope of the Rocky Mountains, but at no very great distance from the Yellowstone Park. Also east of the Rocky Mountains, in the State of Colorado, are several

very large cones and flows of basalt, while to the south of Pucho the bold summits of the Spanish Peaks, which rise respectively to heights of 12,720 and 13,620 feet above the sea, are ancient volcanoes ; but in all these the craters seem to have been destroyed. The materials are described as trachytes, some varieiies approaching rhyolite.

Farther south, however, in the State of New Mexico, are several extinct volcanoes, some of which retain their craters in good preservation. The materials, so far as described, are basalt. Mount Taylor (11,390 feet) also is the centre of a volcanic district. Its crater has perished, but these remain on some of the smaller neighboring cones. The rock apparently is basalt.

The long peninsula of Lower California may be regarded as a prolongation of the chain of the Sierra Nevada. It also contains many extinct volcanoes, which, however, are at present but imperfectly known. Towards the north, according to Professor Russell, Mount Santa Catalina rises to a height of some 10,000 feet, and about the middle is a group of volcanic peaks known as the Tres Virgines, the highest of which is said to be 7250 feet. In this group an eruption occurred in 1857, and since then steam has been ejected, sometimes in great quantity.

THREE MOUNTAIN CHAINS.

Those described above, as Professor Russell remarks, are only some of the most striking instances among the hundreds of lava-flows and craters within the United States ; but it will be noticed that the great majority are associated with the second one of the three mountain chains which form the western flank of the North American continent, the huge eastern mass of the Rocky Mountains being almost entirely, and the smaller western one of the Coast Range being wholly, free from volcanoes of recent date. The Sierra Madre in Mexico, which may be regarded as a prolongation of the Rocky Mountains, appears to exhibit no signs of volcanic action.

Thus a very considerable space separates the volcanoes of the part of Mexico which lies south of the tropic of Cancer, a region

of great activity even in the present day, from those of which we have been speaking. The former also appear not to lie, as usual, along a belt parallel with the western coast, but to be rather irregularly distributed over one, about 150 miles in breadth, which extends from sea to sea in a general direction from W. N. W. to E. N. E. for not much less than 600 miles.

All the volanoes in Mexico which are still active (ten in number according to Reclus) lie south of latitude 22°. The most northerly of them is Ceboruco (about 7140 feet) on the Pacific coast, the centre of a group of craters, which was in eruption in 1870, and has continued steaming ever since. Farther south, near the same coast, is Colima, which has frequently been active. In 1885, the dust from it was carried to the northeast for a distance of 280 miles.

A CELEBRATED VOLCANO.

Proceeding eastwards, and slightly to the south, we come to Jorullo, the eruption of which, ever since the days of Humboldt, has figured so largely in geological text books. This for many years was quoted as an example which very strongly supported the elevation theory of volcanic cones. It was asserted that here a tract of land from three to four miles in extent had almost suddenly swelled up like a bladder, while cones were built by discharges from its surface and at its sides. This happened on the night of September 29, 1759; but, as has been frequently shown, the evidence for this remarkable phenomenon is quite untrustworthy.

Proceeding east, the volcanoes became more lofty. Xinantecatl, some forty miles southwest of the city of Mexico, crowned by two crater-lakes, rises to about 15,000 feet; but east of that city are two giants, Ixtacihuatl to the north, and Popocatepetl to the south. The former, which, however, has lost its crater, is hardly less, perhaps more, than 16,500 feet; but Popocatepetl is about 1200 feet more than this, and terminates in a crater from which a little steam issues. The lower part of the mountain consists of basalt, but the great cone is mostly composed of andesite and its summit is described as trachyte.

Yet farther to the east come Cofre de Perote and Orizaba, which also lie on a north and south line; the former, which is composed of hornblende andesite, has lost its crater and is only 13,552 feet high; but its companion is the highest volcanic summit on the northern continent. The exact measurement is uncertain, but it cannot be much, if at all, less than 18,000 feet. On the summit are three craters in good preservation, and the flanks of the mountain are studded with small cones. Its last eruption is said to have occurred in the eighteenth century.

Finally, on the eastern coast is Tuxtla, reported to be a little less than 5000 feet high, which is active from time to time. A terrible eruption occurred, after a pause of nearly one hundred and twenty years, in March, 1793. A series of violent explosions considerably reduced the height of the mountain and scattered ashes over a large area. The fine dust was borne by the wind about 150 miles to the northwest, and the same distance to the southwest. This fact suggests that, as happened to a less extent in an eruption of Cotopaxi, part of the dust was shot up into a region where an upper stratum of air was moving in a different direction from the lower one.

EXPLOSION AFTER LONG REPOSE.

Still in Mexico, but considerably to the south of the belt described above, and on the shore of the Pacific, is Chacahua, an extinct crater, while to the east of it is Pochutla, a volcano which, after a very long period of repose, exploded in 1870.

From Guatemala to Costa Rica is a zone marked by great volcanic activity, which follows the line of the Pacific coast. Some of the cones on this rise to elevations considerably above 10,000 feet, but the majority do not exceed 8000. In Guatemala, according to a list given by Professor Russell, there are two active volcanoes, four quiescent, and fifteen extinct. Among the last-named is Tajamulco, which lays claim, though probably without warrant, to an altitude of 18,317 feet.

In San Salvador five are active, three quiescent, and the same number extinct. Honduras, which lies chiefly to the east of

the mountain axis, is without an active volcano, but has two quiescent and three extinct. Nicaragua contains four active, eight quiescent, five extinct, while in Costa Rica one only can be called active, and its last eruption was as long ago as 1726, while two are quiescent and six extinct. Lastly, at the northern part of the Isthmus of Panama are three mountains of volcanic origin, two of them over 11,000 feet high, but it is doubtful whether any one retains a remnant of a crater.

Three of the volcanoes in the above-named list are especially interesting, because, like Monte Nuovo, the history of their actual birth is recorded. Two of these are in San Salvador, the third in Nicaragua. Of the former, Izalco, now rising about 3000 feet above the surrounding country and 5000 feet above the sea-level, began to be formed in the year 1770. It covers what previously was a fine cattle farm. "The occupants on this estate were alarmed by subterranean noises and shocks of earthquakes about the end of 1769, which continued to increase in loudness and strength until the twenty-third of the February following, when the earth opened about half a mile from the dwellings on the estate, sending out lava, accompanied by fire and smoke."

HOW THE CONE WAS BUILT UP.

The eruption thus begun went on continuously, lava sometimes being ejected, but at others only ashes and volcanic bombs, and thus the cone has been built up to its present height. No lava has been discharged for many years, but ashes and dust, mingled with steam, are constantly ejected. There are three craters, the central one being the largest and most active. Acid vapors also are emitted from fumaroles. Lake Ilopango, which possibly occupies an ancient crater, also in San Salvador, witnessed the beginning of a volcano as lately as the year 1880.

A violent earthquake in 1879 was accompanied by a rising of steam from the lake, and was followed by a steady fall in the level of its waters, amounting to about thirty-five feet. Then, during the night of January 20, 1880, the surface of the lake was again agitated, and the next morning a pile of rocks was observed in

the centre, from which rose a column of vapor. The eruption lasted for more than a month, sulphurous vapors were emitted copiously, the fish in the lake were killed, and a cone was ultimately formed about 160 feet above the water, but rising from a depth of some 600 feet.

A new volcano broke out on April 11, 1850, in Nicaragua, in a district called the Plain of Leon. This is studded with cones, of which one at least is active. The commencement of the eruption was not carefully observed, but the outbreak occurred near the base of an extinct crater called Las Pilas. It began with a copious discharge of lava.

This ceased on the fourteenth of the month, and was succeeded by a different phase of action, namely, a series of paroxysms lasting about three minutes, with intervals of about the same length. By these, steam, ashes, and red-hot bombs were shot up to a height of several hundred feet, accompanied, it is said, by outbursts of flame. Thus in the course of a week a cone was built up to a height of from a hundred and fifty to two hundred feet, after which the action became much more intermittent.

THREE SOUTH AMERICAN PEAKS.

Among the older summits of Central America it may suffice to mention three, all of which are lofty mountains. Volcan de Agua, 12,213 feet, at the time of the Spanish invasion was a crater-lake. In the year 1541, after an earthquake, the wall of the crater gave way on the northeastern side and the water escaped, doing great damage as it rushed down the slope of the mountain. Fuego, to the east, with its group of three volcanic cones, the highest of which attains to 13,943 feet, was often active in the sixteenth and seventeenth centuries, and probably for some long time previously; but since then eruptions have been less frequent, though one occurred as late as 1860, and steam still issues from the crater.

But the most noted of all is Coseguina, for it was the scene of a frightful eruption in the year 1835. So far as is known, this, like the famous awakening of Vesuvius in the year 79, put an

end to a long period of complete repose. It began on the morning of January 20th, when several loud detonations were heard, followed by the ejection of a cloud of inky smoke, through which "darted tongues of flame resembling lightning." The cloud spread gradually outward, obscuring the sun, while fine dust fell from it like rain. This went on for two days, the sand falling more and more thickly and the explosions becoming louder and louder.

On the third day they reached a maximum and the darkness became intense. The quantity of material that fell was so great that for leagues around people actually deserted their houses, fearing lest their roofs might be crushed in. At Leon, more than a hundred miles away, the dust lay several inches deep, and it was carried to Jamaica, Vera Cruz and Santa Fé de Bogota, over an area of 1500 miles in diameter. The sea also was covered with floating masses of pumice for a distance of some fifty leagues.

FOUR MILES IN DIAMETER.

During the eruption the height of the cone was considerably reduced, but to what extent is not certainly known; probably by at least one half, for it is now a crater four miles in diameter and only 3600 feet above the sea. Many of the phenomena during this outbreak closely agree with those associated with the first eruption of Vesuvius and that of Krakatoa already described.

The Isthmus of Panama, though its hills in places are comparatively low and without volcanic cones, links together the great mountain chains of North and South America. But that of the Andes, which extends along the whole western flank of the latter, is rather less complicated in structure than the system of the former country. It is a single chain, consisting partly of sedimentary, partly of igneous rocks, old and new, both crystalline and volcanic. The sedimentaries and the older igneous form the lower part of the great mountain wall, and the volcanoes, generally speaking, rise more nearly from its crest than from its flanks.

They are not, however, continuous along the whole chain, but

form three principal groups—those of Colombia and Ecuador in the north, those of Bolivia in the centre, and those of Chili in the south. About sixty craters are still active; those which are extinct and more or less ruined may be counted by hundreds. The first group, in the more northern part, consists of three principal ranges, of which the eastern one branches out at last into the great mountains which runs roughly parallel with the border of the Caribbean Sea.

The western range is less elevated than the others, at any rate in its more northern part; the central, on which the volcanoes are chiefly situated, supports many lofty peaks. Of these Mesa de Herveo, 18,340 feet, retains its ancient crater; Ruiz, 17,189 feet; Tolima, 18,392 feet; and Huila, 18,701, all show some signs of life. An eruption occurred at Puracé, 15,425 feet, in 1849, when the torrents of mud caused by the rapid melting of the snow caused much devastation. Extinct volcanoes are also frequent. In the eastern chain no vents are mentioned as active.

FIERY SUMMITS OF ECUADOR.

Passing into Ecuador, the volcanic summits, according to Mr. Whymper, are grouped along two roughly parallel lines. On the western, Cotocachi, Pichincha, Corazon, Illiniza, Carihuairazo, and Chimborazo are the most important; on the eastern, Cayambe, Antisana, Sincholagua, Cotopaxi, Altar, and Sangai. Of these the majority have lost their craters, including Chimborazo. Altar retains one, so does Pichincha, which apparently is hardly extinct, while Sangai and Cotopaxi, which has been already described, are still active.

It may suffice to say that the specimens brought back by Mr. Whymper were almost without exception varieties of andesite, several of them containing hypersthene. Antisana, however, also furnished a pitchstone. The volcanic cones, according to Reiss and Wolf, continue for some distance to the south of those which have been mentioned.

In the Peruvian and Bolivian Andes we find the second linear group of craters. The same arrangement in parallel lines

to continue, and the highest summit, Hauscan, is said to overtop Chimborazo by rather more than 1300 feet. Volcanic cones are most frequent in the southern part of the western range, where they set in again some 1200 miles from those of Ecuador. Few, however, are mentioned as active in historic times; among them Ubinas, Omate, Candarave (18,964 feet), are enumerated by Reclus. But among the extinct volcanoes some also rise to great heights, such as Sara-Sara, Achatayhua, Coro Puna, Ampato, Misti, and Chachani, all of which exceed 13,000 feet, the last reaching 19,767 feet and Misti 18,504 feet.

This volcanic group continues into Bolivia, and there are some active craters, especially near Lake Titicaca. Presumably the higher peaks of this country, five of which are enumerated as over 21,000 feet, and the highest, Illimani, reaching 22,350 feet, are volcanic, and the last is said to smoke constantly. Altogether, sixteen craters are asserted to be active in this second group of Andres volcanoes, of which, at present, our knowledge is rather imperfect.

LONG CEASED TO BE ACTIVE.

Passing on to the third group, the volcanoes of Chili, we find these numerous, though, for the most part, they have long ceased to be active. In the northern part, however, two at least, Llullaillaco (17,061 feet) and Dona Inez are still at work. In the middle are the highest summits—Aconagua, 22,867 feet; Cerro del Mercedario, 22,302 feet; Tupungato, 10,269 feet; San José, 20,000 feet; and Maipo, 17,657 feet. Of these, Aconagua has entirely lost its crater, and Tupungato retains due distinctive trace of it, but one or two vents are still active; one about 13,000 feet high, lying some twenty miles to the southwest of Tupungato. In this part also, according to Mr. FitzGerald, the Andes consist of two ranges, of which the western is the watershed; the other supports the highest peaks. There is also a third and eastern range, but this is separated from the main chain by a valley only about 4000 feet above sea level.

The rocks brought back by Messrs. FitzGerald and Vines are mostly andesites, the actual summits of Aconagua and Tupun-

gato being the hornblende-bearing variety of that rock, though a rhyolite or dacite was obtained on the flank of the latter mountain. The volcanic line does not completely come to an end with Chili, for Corcovado (7510 feet) in the Patagonian Andes is a volcano, but though there may be some extinct cones yet farther south, the active vents are not continued to Cape Horn.

CHAPTER XVII

RIDGE OF PANAMA AND THE ANDES.—THE GREAT CANYON.—CALIFORNIA AND UTAH.—YELLOWSTONE PARK.—MEXICO AND SOUTH AMERICA.

IN no point is there a more remarkable contrast between the physical structure of Eastern and Western America than in the absence of volcanic phenomena in the former and their prodigious development in the latter. The great valley of the Mississippi and its tributaries forms the dividing territory between the volcanic and non-volcanic areas; so that on crossing the high ridges in which the western tributaries of America's greatest river have their sources, and to which the name of the "Rocky Mountains" more properly belongs, we find ourselves in a region which, throughout the later Tertiary times down almost to the present day, has been the scene of volcanic operations on the grandest scale; where lava-floods have been poured over the country through thousands of square miles, and where volcanic cones, vying in magnitude with those of Etna, Vesuvius, or Hecla, have established themselves.

This region, generally known as "The Great Basin," is bounded on the west by the "Pacific Range" of mountains, and includes portions of New Mexico, Arizona, California, Nevada, Utah, Colorado, Idaho, Oregon, Wyoming, Montana and Washington. To the south it passes into the mountainous region of Mexico, also highly volcanic; and thence into the ridge of Panama and the Andes. It cannot be questioned but that the volcanic nature of the Great Basin is due to the same causes which have originated the volcanic outbursts of the Andes; but, from whatever cause, the volcanic forces have here entered upon their secondary or moribund stage.

In the Yellowstone Valley, geysers, hot springs and fumaroles give evidence of this condition. In other districts the lava streams are so fresh and unweathered as to suggest that they had been

erupted only a few hundred years ago; but no active vent or crater is to be found over the whole of this wide region. A few special districts only can here be selected by way of illustration of its special features in connection with its volcanic history.

This tract, which is drained by the Colorado river and its tributaries, is bounded on the north by the Wahsatch range, and extends eastward to the base of the Sierra Nevada. Round its margin extensive volcanic tracts are to be found, with numerous peaks and truncated cones—the ancient craters of eruption—of which Mount San Francisco is the culminating eminence.

South of the Wahsatch, and occupying the high plateaux of Utah, enormous masses of volcanic products have been spread over an area of 9000 square miles, attaining a thickness of between 3000 and 4000 feet. The earlier of these great lava-floods appear to have been trachytic, but the later basaltic; and in the opinion of Captain Dutton, who has described them, they range in point of time from the Middle Tertiary (Miocene) down to comparatively recent times.

HIGH LEVELS IN UTAH.

To the south of the high plateaux of Utah are many minor volcanic mountains, now extinct; and as we descend towards the Grand Canon of Colorado we find numerous cinder cones scattered about at intervals near the cliffs. Extensive lava fields, surmounted by cinder cones, occupy the plateau on the western side of the Grand Canon; and, according to Dutton, the great sheets of basaltic lava, of very recent age, which occupy many hundred square miles of desert, have had their sources in these cones of eruption.

Crossing to the east of the Grand Canon, we find other lava floods poured over the country at intervals, surmounted by San Francisco—a volcanic mountain of the first magnitude—which reaches an elevation, according to Wheeler, of 12,562 feet above the ocean. It has long been extinct, and its summit and flanks are covered with snow fields and glaciers. Other parts of Arizona are overspread by sheets of basaltic lava, through which old

"necks" of eruption, formed of more solid lava than the sheets, rise occasionally above the surface, and are prominent features in the landscape.

Further to the eastward in New Mexico, and near the margin of the volcanic region, is another volcanic mountain little less lofty than San Francisco, called Mount Taylor, which, according to Dutton, rises to an elevation of 11,390 feet above the ocean, and 8200 feet above the general level of the surrounding plateau of lava. This mountain forms the culminating point of a wide volcanic tract, over which are distributed numberless vents of eruption. Scores of such vents—generally cinder cones—are visible in every part of the plateau, and always in a more or less dilapidated condition. Mount Taylor is a volcano, with a central pipe terminating in a large crater, the wall of which was broken down on the east side in the later stage of its history.

VOLCANIC RANGES.

Proceeding westward into California, we are again confronted with volcanic phenomena on a stupendous scale. The coast range of mountains, which branches off from the Sierra Nevada at Mount Pinos, on the south, is terminated near the northern extremity of the State by a very lofty mountain of volcanic origin, called Mount Shasta, which attains an elevation of 14,511 feet. This mountain was first ascended by Clarence King in 1870, and although forming, as it were, a portion of the Pacific Coast Range, it really rises from the plain in solitary grandeur, its summit covered by snow, and originating several fine glaciers.

The summit of Mount Shasta is a nearly perfect cone, but from its northwest side there juts out a large crater-cone just below the snow line, between which and the main mass of the mountain their exists a deep depression filled with glacier ice. This secondary crater-cone has been named Mount Shastina, and round its inner side the stream of glacier ice winds itself, sometimes surmounting the rim of the crater, and shooting down masses of ice into the great cauldron.

The length of this glacier is about three miles, and its breadth

about 4000 feet. Another very lofty volcanic mountain is Mount Rainier, in the Washington territory, consisting of three peaks of which the eastern possesses a crater very perfect throughout its entire circumference. This mountain appears to be formed mainly of trachytic matter. Proceeding further north into British territory, several volcanic mountains near the Pacific coast are said to exhibit evidence of activity.

Of these may be mentioned Mount Edgecombe, Mount Fairweather, which rises to a height of 14,932 feet; and Mount St. Elias, just within the divisional line between British and Russian territory, and reaching an altitude of 16,860 feet. This, the loftiest of all of the volcanoes of the North American continent, except those of Mexico, may be considered as the connecting link in the volcanic chain between the continent and the Aleutian Islands.

LAKES AND THEIR ORIGIN.

Returning to Utah we are brought into contact with phenomena of special interest, owing to the inter-relations of volcanic and lacrustine conditions which once prevailed over large tracts of that territory. The present Great Salt Lake, and the smaller neighboring lakes, those called Utah and Sevier, are but remnants of an originally far greater expanse of inland water, the boundaries of which have been traced out by Mr. C. K. Gilbert, and described under the name of Lake Bonneville.

The waters of this lake appear to have reached their highest level at the maximum cold of the Post Pliocene period, when the glaciers descended to its margin, and large streams of glacier water were poured into it. Eruptions of basaltic lava from successive craters appear to have gone on before, during, and after the lacustrine epoch; and the drying up of the waters over the greater extent of their original area, now converted into the Sevier Desert, and their concentration into their present comparatively narrow basins, appears to have proceeded pari passu with the gradual extinction of the volcanic outbursts.

Two successive epochs of eruption of basalt appears to have been clearly established—an earlier one of the "Provo Age,"

when the lava was extruded from the Tabernacle craters, and a later epoch, when the eruptions took place from the Ice Spring craters. The oldest volcanic rock appears to be rhyolite, which peers up in two small hills almost smothered beneath the lake deposits. Its eruption was long anterior to the lake period.

On the other hand, the cessation of the eruptions of the later basaltic sheets is evidently an event of such recent date that Mr. Gilbert is led to look forward to their resumption at some future, but not distant, epoch. As he truly observes, we are not to infer that, because the outward manifestations of volcanic action have ceased, the internal causes of those manifestations have passed away. These are still in operation, and must make themselves felt when the internal forces have recovered their exhausted energies ; but perhaps not to the same extent as before.

COUNTRY BORDERING SNAKE RIVER.

The tract of country bordering the Snake River in Idaho and Washington is remarkable for the vast sheets of plateau-basalt with which it is overspread, extending sometimes in one great flood farther than the eye can reach, and what is still more remarkable, they are often unaccompanied by any visible craters or vents of eruption. In Oregon the plateau-basalt is at least 2000 feet in thickness, and where traversed by the Columbia River it reaches a thickness of about 3000 feet.

The Snake and Columbia rivers are lined by walls of volcanic rock, basaltic above, trachytic below, for a distance of, in the former, one hundred, in the latter, two hundred, miles. Captain Dutton, in describing the High Plateau of Utah, observes that the lavas appear to have welled up in mighty floods without any of that explosive violence generally characteristic of volcanic action. This extravasated matter has spread over wide fields, deluging the surrounding country like a tide in a bay, and overflowing all inequalities. Here also we have evidence of older volcanic cones buried beneath seas of lava subsequently extruded.

The absence or rarity, of volcanic craters or cones of eruption in the neighborhood of these great sheets has led American geolo-

gists to the conclusion that the lavas were in many cases extruded from fissures in the earth's crust rather than from ordinary craters. This view is also urged by Sir A. Geikie, who visited the Utah region of the Snake River in 1880, and has vividly described the impression produced by the sight of these vast fields of basaltic lava.

He says, "We found that the older trachytic lavas of the hills had been deeply trenched by the lateral valleys and that all these valleys had a floor of black basalt that had been poured out as the last of the molten material from the now extinct volcanoes. There were no visible cones or vents from which these floods of basalt could have proceeded. We rode for hours by the margin of a vast plain of basalt stretching southward and westward as far as the eye could reach. I realized the truth of an assertion made first by Richthofen, that our modern volcanoes, such as Vesuvius and Ætna, present us with by no means the grandest type of volcanic action, but rather belong to a time of failing activity. There have been periods of tremendous volcanic energy, when instead of escaping from a local vent, like a Vesuvian cone, the lava has found its way to the surface by innumerable fissures opened for it in the solid crust of the globe over thousands of square miles."

HISTORY OF THE ERUPTIONS.

The general succession of volcanic events throughout the region of Western America appears to have been somewhat as follows:

The earliest volcanic eruptions occurred in the later Eocene epoch and were continued into the succeeding Miocene stage. These consisted of rocks moderately rich in silica, and are grouped under the heads of propylite and andesite. To these succeeded during the Pliocene epoch still more highly silicated rocks of trachytic type, consisting of sanidine and oligoclase trachytes.

Then came eruptions of rhyolite during the later Pliocene and Pleistocene epoch; and lastly, after a period of cessation, during which the rocks just described were greatly eroded, came

the great eruptions of basaltic lava, deluging the plains, winding round the cones or plateaux of the older lavas, descending into the river valleys and flooding the lake beds, issuing from both vents and fissures, and continuing intermittently down almost into the present day—certainly into the period of man's appearance on the scene.

Thus the volcanic history of Western America corresponds remarkably to that of the European regions with which we have previously dealt, both as regards the succession of the various lavas and the epochs of their eruption.

The geysers and hot springs of the Yellowstone Park, like those in Iceland and New Zealand, are special manifestations of volcanic action, generally in its secondary or moribund stage. The geysers of the Yellowstone occur on a grand scale; the eruptions are frequent, and the water is projected into the air to a height of over 200 feet. Most of these are intermittent, like the remarkable one known as Old Faithful, the Castle Geyser, and the Giantess Geyser described by Dr. Hayden, which ejects the water to a height of 250 feet.

TINTS OF RED AND YELLOW.

The geyser waters hold large quantities of silica and sulphur in solution, owing to their high temperature under great pressure, and these minerals are precipitated upon the cooling of the waters in the air, and form circular basins, often gorgeously tinted with red and yellow colors.

In the great Pacific Ocean, the Islands may be referred to two classes, distinguished by their elevation into high and low. The latter class appear to be entirely of modern formation, the product of that accumulation of coral reefs which Flinders and others have described in so interesting a manner. The high islands, on the contrary, are chiefly volcanic, though in the Friendly and Marquesa Islands primitive rocks occur, and in the Waohoo porphyry and amygdaloid.

The Mariana or Ladrone Islands constitute a sort of mountain chain, consisting of a line of active volcanoes, especially

towards their north, which is parallel to that of the Philippine group, whereas the islands that lie detached in the middle of the basin, of which these two groups are the boundaries, seem for the most part to be extinguished.

Mr. Ellis, a missionary, has given in a narrative of a Tour Through the Hawaii Islands a most detailed account of the active volcano of Hawaii.

The plain over which their way to the mountain lay was a vast waste of ancient lava, which he thus describes :—"The tract of lava resembled in appearance an inland sea, bounded by distant mountains. Once it had certainly been in a fluid state, but appeared as if it had become suddenly petrified, or turned into a glassy stone, while its agitated billows were rolling to and fro. Not only were the large swells and hollows distinctly marked, but in many places the surface of these billows was covered by a smaller ripple, like that observed on the surface of the sea at the springing up of a breeze, or the passing currents of air, which produce what the sailors call a cats-paw.

EDGE OF A STEEP PRECIPICE.

"About 2 P. M. the crater of Kilauea suddenly burst upon our view. We expected to have seen a mountain with a broad base and rough, indented sides, composed of loose slags, or hardened streams of lava, and whose summit would have presented a rugged wall of scoria, forming the rim of a mighty cauldron. But instead of this, we found ourselves on the edge of a steep precipice, with a vast plain before us fifteen or sixteen miles in circumference, and sunk from two hundred to four hundred feet below its original level. The surface of this plain was uneven, and strewed over with huge stones and volcanic rock, and in the center of it was the great crater, at the distance of a mile and a half from the place where we were standing. We walked on to the north end of the ridge, where, the precipice being less steep, a descent to the plain below seemed practicable. With all our care, we did not reach the bottom without several falls and slight bruises.

"After walking some distance over the sunken plain, which

in several places sounded hollow under our feet, we at length came to the edge of the great crater, where a spectacle sublime, and even appalling, presented itself before us. Immediately before us yawned an immense gulf, in the form of a crescent, about two miles in length, from N. E. to S. W., nearly a mile in width, and apparently eight hundred feet deep. The bottom was covered with lava, and the S. W. and northern parts of it were one vast flood of burning matter, in a state of terrific ebullition, rolling to and fro its 'fiery surge' and flaming billows.

A BURNING LAKE.

"Fifty-one conical islands of varied form and size, containing so many craters, rose either round the edge, or from the surface of the burning lake; twenty-two constantly emitted columns of grey smoke, or pyramids of brilliant flame; and several of these at the same time vomited from their ignited mouths streams of lava, which rolled in blazing torrents down their black indented sides, into the boiling mass below. The existence of these conical craters led us to conclude that the boiling cauldron of lava before us did not form the focus of the volcano; that this mass of melted lava was comparatively shallow; and that the basin in which it was contained was separated by a stratum of solid matter from the great volcanic abyss, which constantly poured out its melted contents through these numerous craters into this upper reservoir.

"The sides of the gulch before us, although composed of different strata of ancient lava, were perpendicular for about four hundred feet, and rose from a wide horizontal ledge of solid black lava of irregular breadth, but extending completely round, beneath this ledge, the sides sloped gradually towards the burning lake. which was, as nearly as we could judge, three hundred or four hundred feet lower. It was evident that the large crater had been recently filled with liquid lava up to this black ledge, and had, by some subterraneous canal, emptied itself into the sea or under the low land on the shore.

"The grey, and in some places apparently calcined sides of the great crater before us—the fissures which intersected the sur-

face of the plain on which we were standing—the long banks of sulphur on the opposite side of the abyss—the vigorous action of the numerous small craters on its borders—the dense columns of vapor and smoke that rose at the N. and S. end of the plain—together with the ridge of steep rocks by which it was surrounded, rising probably in some places three or four hundred feet in a perpendicular height, presented an immense volcanic panorama, the effect of which was greatly augmented by the constant roaring of the vast furnaces below

"The natives still persist in believing, that the conical craters of the mountains are the houses of their gods, where they frequently amuse themselves by playing at Konané (a game like draughts); that the roaring of the furnaces and the crackling of the flames are the music of their dance, and that the red flaming surge is the surf in which they play, sportively swimming on the rolling wave. Some of their legends may remind us of those that prevailed among the Greeks.

CURIOUS OLD LEGEND.

"Thus one of their kings, who had offended Pélé, the principal goddess of the volcano, is pursued by her to the shore, where leaping into a canoe he paddles out to sea. Pélé, perceiving his escape, hurls after him huge stones and fragments of rock, which fall thickly around, but do not strike the canoe. A number of rocks in the sea are shown by the natives, which like the Cyclopean Islands at the foot of Mount Etna, are said to have been those thrown by Pélé to sink the boat.

"This legend is very characteristic of the manners and feelings of savage life. The king is represented as taking little pains to secure the escape of anyone but himself, for his mother, wife and children are all abandoned without compunction; his conduct to the friend who accompanies him is the only trait which redeems his character from the charge of utter selfishness, nor among the natives who tell the story, is their praise of the adroitness with which he effected his escape, at all less commended on account of this desertion of his nearest relations."

The globe is girdled by a chain of volcanic mountains in a state of greater or less activity, which may, perhaps, be considered a girdle of safety for the whole world, through which the masses of molten matter in a state of high pressure beneath the crust find a way of escape; and thus the structure of the globe is preserved from even greater convulsions than those which from time to time take place at various points on its surface.

This girdle is partly terrestrial, partly submarine; and commencing at Mount Erebus, near the Antarctic Pole, ranging through South Shetland Isle, Cape Horn, the Andes of South America, the Isthmus of Panama, then through Central America and Mexico, and the Rocky Mountains to Kamtschatka, the Aleutian Islands, the Kuriles, the Japanese, the Philippines, New Guinea, and New Zealand, reaches the Antartic Circle by the Balleny Islands. This girdle sends off branches at several points.

DORMANT VOLCANIC EVENTS.

The linear arrangement of active or dormant volcanic vents has been pointed out by Humboldt, Von Buch, Daubeny and other writers. The great range of burning mountains of the Andes of Chili, Peru, Bolivia, and Mexico, that of the Aleutian Islands of Kamtschatka and the Kurile Islands, extending southwards into the Philippines, and the branching range of the Sunda Islands are well known examples. That of the West Indian Islands, ranging from Grenada through St. Vincent, St. Lucia, Martinique, Dominica, Gaudeloupe, Montserrat, Nevis, and St. Eustace, is also a remarkable example of the linear arragement of volcanic mountains. On tracing these ranges on a map of the world it will be observed that they are either strings of islands, or lie in proximity to the ocean; and hence the view was naturally entertained by some writers that oceanic water, or at any rate that of a large lake or sea, was a necessary agent in the production of volcanic eruptions.

This view seems to receive further corroboration from the fact that the interior portions of the continents and large islands such as Australia are destitute of volcanoes in action, with the

remarkable exceptions of Mounts Kenia and Kilimanjaro in Central Africa, and a few others. It is also very significant in this connection that many of the volcanoes now extinct, or at least dormant, both in Europe and Asia, appear to have been in proximity to sheets of water during the period of activity.

Thus the old volcanoes of the Hauran, east of the Jordan, appear to have been active at the period when the present Jordan valley was filled with water to such an extent as to constitute a lake two hundred miles in length, but which has now shrunk back to within the present limits of the Dead Sea. Again, at the period when the extinct volcanoes of Central France were in active operation, an extensive lake overspread the tract lying to the east of the granitic plateau on which the craters and domes are planted, now constituting the rich and fertile plain of Clermont.

WATER AND EXPLOSIONS.

Such instances are too significant to allow us to doubt that water in some form is very generally connected with volcanic operations; but it does not follow that it was necessary to the original formation of volcanic vents, whether linear or sporadic. If this were so, the extinct volcanoes of the British Isles would still be active, as they are close to the sea-margin, and no volcano would now be active which is not near to some large sheet of water.

But Jorullo, one of the great active volcanoes of Mexico, lies no less than 120 miles from the ocean, and Cotopaxi, in Ecuador, is nearly equally distant. Kilimanjaro, 18,881 feet high, and Kenia, in the equatorial regions of Central Africa, are about 150 miles from the Victoria Nyanza, and a still greater distance from the ocean; and Mount Demavend, in Persia, which rises to an elevation of 18,464 feet near the southern shore of the Caspian Sea, a volcanic mountain of the first magnitude, is now extinct or dormant.

Such facts as these all tend to show that although water may be an accessory of volcanic eruptions, it is not in all cases essential; and we are obliged, therefore, to have recourse to some

other theory of volcanic action differing from that which would attribute it to the access of water to highly heated or molten matter within the crust of the earth.

The view of Leopold von Buch, who considered that the great lines of volcanic mountains above referred to rise along the borders of rents, or fissures, in the earth's crust, is one which is inherently probable, and is in keeping with observation. That the crust of the globe is to a remarkable extent fissured and torn in all directions is a phenomenon familiar to all field geologists. Such rents and fissures are often accompanied by displacement of the strata, owing to which the crust has been vertically elevated on one side or lowered on the other, and such displacements (or "faults") sometimes amount to thousands of feet.

A SYSTEM OF FISSURES.

It is only occasionally, however, that such fractures are accompanied by the extrusion of molten matter; and in the north of England and Scotland dykes of igneous rock, such as basalt, which run across the country for many miles in nearly straight lines, often cut across the faults, and are only rarely coincident with them. Nevertheless, it can scarcely be a question that the grand chain of volcanic mountains which stretches almost continuously along the Andes of South America, and northwards through Mexico, has been piled up along the line of a system of fissures in the fundamental rocks parallel to the coast, though not actually coincident therewith.

The structure and arrangemnt of the Cordilleras of Quito, for example, are eminently suggestive of arrangement along lines of fissure. As shown by Alexander von Humboldt, the volcanic mountains are disposed in two parallel chains, which run side by side for a distance of over 500 miles northwards into the State of Columbia, and enclose between them the high plains of Quito and Lacunga. Along the eastern chain are the great cones of El Altar, rising to an elevation of 16,383 feet above the ocean, and having an enormous crater apparently dormant or extinct, and covered with snow; then Cotopaxi, its sides covered with

snow, and sending forth from its crater several columns of smoke; then Guamani and Cayambe (19,000 feet), huge truncated cones apparently extinct; these constitute the eastern chain of volcanic heights.

The western chain contains even loftier mountains. Here we find the gigantic Chimborazo, an extinct volcano whose summit is white with snow; Carihuairazo and Illiniza, a lofty pointed peak like the Matterhorn; Corazon, a snow-clad dome, reaching a height of 15,871 feet; Atacazo and Pichincha, the latter an extinct volcano reaching an elevation of 15,920 feet; such is the western chain, remarkable for its straightness, the volcanic cones being planted in one grand procession from south to north. This rectilinear arrangement of the western chain, only a little less conspicuous in the eastern, is very suggestive of a line of fracture in the crust beneath.

And when we contemplate the prodigious quantity of matter included within the limits of these colossal domes and their environments, all of which has been extruded from the internal reservoirs, we gain some idea of the manner in which the contracting crust disposes of the matter it can no longer contain.

QUITO AND PERU.

Between the volcanoes of Quito and those of Peru there is an intervening space of fourteen degrees of latitude. This is occupied by the Andes, regarding the structure of which we have not much information except that at this part of its course it is not volcanic. But from Arequipa in Peru, an active volcano, we find a new series of volcanic mountains continued southwards through Tacora (19,740 feet), then further south the more or less active vents of Sajama (22,915 feet), Coquina, Tutupaca, Calama, Atacama, Toconado, and others, forming an almost continuous range with that part of the desert of Atacama pertaining to Chili.

Through this country we find the volcanic range appearing at intervals; and still more to the southwards it is doubtless connected with the volcanoes of Patagonia, north of the Magellan Straits, and of Terra del Fuego. Mr. David Forbes considers

that this great range of volcanic mountains, lying nearly north and south, corresponds to a line of fracture lying somewhat to the east of the range.

A similar statement in all probability applies to the systems of volcanic mountains of the Aleutian Isles, Kamtschatka, the Kuriles, the Philippines, and Sunda Isles. Nor can it be reasonably doubted that the Western American coast line has to a great extent been determined, or marked out, by such lines of displacement; for, as Darwin has shown, the whole western coast of South America, for a distance of between 2000 and 3000 miles south of the Equator, has undergone an upward movement in very recent times—that is, within the period of living marine shells—during which period the volcanoes have been in activity.

GROUPS OF VOLCANOES.

This chain may also be cited in evidence of volcanic action along fissure lines. It connects the volcanoes of Kamtschatka with those of Japan, and the linear arrangement is apparent. In the former peninsula Erman counted no fewer than thirteen active volcanic mountains rising to heights of 12,000 to 15,000 feet above the sea. In the chain of the Kuriles Professor John Milne counted fifty-two well-defined volcanoes, of which nine, perhaps more, are certainly active.

They are not so high as those of Kamtschatka; but, on the other hand, they rise from very deep oceanic waters, and have been probably built up from the sea bottom by successive eruptions of tuff, lava, and ash. According to the view of Professor Milne, the volcanoes of the Kurile chain are fast becoming extinct.

Besides the volcanic vents arranged in lines, of which we have treated above, there are a large number, both active and extinct, which appear to be disposed in groups, or sporadically distributed, over various portions of the earth's surface. I say appear to be, because this sporadic distribution may really be resolvable (at least in some cases) into linear distribution for short distances. Thus the Neapolitan Group, which might at first sight seem to

be arranged around Vesuvius as a centre, really resolves itself into a line of active and extinct vents of eruption, ranging across Italy from the Tyrrhenian Sea to the Adriatic, through Ischia, Procida, Monte Nuovo and the Phlegræan Fields, Vesuvius and Mount Vulture.

Again, the extinct volcanoes of Central France, which appear to form an isolated group, indicate, when viewed in detail, a linear arrangement ranging from north to south. Another region over which extinct craters are distributed lies along the banks of the Rhine, above Bonn and the Moselle; a fourth in Hungary; a fifth in Asia Minor and Northern Palestine; and a sixth in Central Asia around Lake Balkash. These are all continental, and the linear distribution is not apparent.

By far the most extensive regions with sporadically distributed volcanic vents, both active and extinct, are those which are overspread by the waters of the ocean, where the vents emerge in the form of islands. These are to be found in all the great oceans, the Atlantic, the Pacific, and the Indian; but are especially numerous over the central Pacific region.

VOLCANIC CORAL REEFS.

As Kotzebue and subsequently Darwin have pointed out, all the islands of the Pacific are either coral-reefs or of volcanic origin; and many of these rise from great depths; that is to say, from depths of 1000 to 2000 fathoms. It is unnecessary here to attempt to enumerate all these islands which rise in solitary grandeur from the surface of the ocean, and are the scenes of volcanic operations; a few may, however, be enumerated.

In the Atlantic, Iceland first claims notice, owing to the magnitude and number of its active vents and the variety of the accompanying phenomena, especially the geysers. As Lyell has observed, with the exception of Etna and Vesuvius, the most complete chronological records of a series of eruptions in existence are those of Iceland, which come down from the ninth century of our era, and which go to show that since the twelfth century there has never been an interval of more than forty years without either

an eruption or a great earthquake. So intense is the volcanic energy in this island that some of the eruptions of Hecla have lasted six years without cessation.

Earthquakes have often shaken the whole island at once, causing great changes in the interior, such as the sinking down of hills, the rending of mountains, and the desertion by rivers of their channels, and the appearance of new lakes. New islands have often been thrown up near the coast, while others have disappeared. In the intervals between eruptions, innumerable hot springs afford vent to the subterranean heat, and solfataras discharge copious streams of inflammable matter. The volcanoes in different parts of the island are observed, like those of the Phlegræan Fields, to be in activity by turns, one vent serving for a time as a safety-valve for the others.

A HISTORIC ERUPTION.

The most memorable eruption of recent years was that of Skapta Jokul in 1783, when a new island was thrown up, and two torrents of lava issued forth, one forty-five and the other fifty miles in length, and which, according to the estimate of Professor Bischoff, contained matter surpassing in magnitude the bulk of Mont Blanc. One of these streams filled up a large lake, and entering the channel of the Skapta, completely dried up the river. The volcanoes of Iceland may be considered as safety-valves to the region in which lie the British Isles.

This group of volcanic isles rises from deep Atlantic waters north of the Equator, and the vents of eruption are partially active, partially dormant, or extinct. It must be supposed, however, that at a former period volcanic action was vastly more energetic than at present; for except at the Grand Canary, Gomera, Forta Ventura and Lancerote, where various non-volcanic rocks are found, these islands appear to have been built up from their foundations of eruptive materials.

The highest point in the Azores is the Peak of Pico, which rises to a height of 7016 feet above the ocean. But this great elevation is surpassed by that of the Peak of Teneriffe (or Pic de

Teyde) in the Canaries, which attains to an elevation of 12,225 feet, as determined by Professor Piazzi Smyth.

This great volcanic cone, rising from the ocean, its summit shrouded in snow, and often protruding above the clouds, must be an object of uncommon beauty and interest when seen from the deck of a ship. The central cone, formed of trachyte, pumice, obsidian and ashes, rises out of a vast cauldron of older balsaltic rocks with precipitous inner walls—much as the cone of Vesuvius rises from within the partially encircling walls of Somma. From the summit issue forth sulphurous vapors, but no flame.

OUTER RING OF BASALT.

Piazzi Smyth, who during a prolonged vist to this mountain in 1856 made a careful survey of its form and structure, shows that the great cone is surrounded by an outer ring of basalt enclosing two foci of eruption, the lavas from which have broken through the ring of the outer crater on the western side, and have poured down the mountain. At the top of the peak its once active crater is filled up, and we find a convex surface ("The Plain of Rambleta") surmounted towards its eastern end by a diminutive cone, 500 feet high, called "Humboldt's Ash Cone." The slope of the great cone of Teneriffe ranges from 28° to 38°; and below a level of 7000 feet the general slope of the whole mountain down to the water's edge varies from 10° to 12° from the horizontal. The great cone is penetrated by numerous basaltic dykes.

The Cape de Verde Islands, which contain beds of limestone along with volcanic matter, possess in the island of Fuego an active volcano, rising to a height of 7000 feet above the surface of the ocean. The central cone, like that of Teneriffe, rises from within an outer crater, formed of basalt alternating with beds of agglomerate, and traversed by numerous dykes of lava. This has been broken down on one side like that of Somma; and over its flanks are scattered numerous cones of scoria, the most recent dating from the years 1785 and 1799.

CHAPTER XVIII.

Amazing Phenomena Connected with Volcanoes and Earthquakes.—Fiery Explosions and Mountains in Convulsions.—Changes in the Surface of the Earth.

BY SIR. JOHN F. W. HERSCHEL, BART.

[The following accurate and scientific account of the causes and effects of volcanoes and earthquakes is furnished by the most eminent authority on these subjects known to the world, and is of special interest in connection with the great disasters in California.]

I PURPOSE to say something about volcanoes and earthquakes. It is a subject I have thought a good deal about, and though I have never been so fortunate as to have been shaken out of my bed by an earthquake, still I have climbed the cones of Vesuvius and Etna, hammer in hand and barometer on back, and have wandered over and geologized among, I believe, nearly all the principal scenes of extinct volcanic activity in Europe.

Every one knows that a volcano is a mountain that vomits out fire, and smoke, and cinders, and melted lava, and sulphur, and steam, and gases, and all kinds of horrible things; nay, even sometimes mud, and boiling water, and fishes; and everybody has heard or read of the earth opening, and swallowing up man and beast, and houses and churches; and closing on them with a snap, and smashing them to pieces; and then perhaps opening again, and casting them out with a flood of dirty water from some river or lake that has been gulped down with them. Now, all this, and much more, is literally true, and has happened over and over again; and when we have imagined it all, we shall have formed a tolerably correct notion of some at least of these visitations.

And perhaps some may have been tempted to ask why and how it is that God has permitted this fair earth to be visited with such destruction. It can hardly be for the sins of men: for when these things occur they involve alike the innocent and the guilty; and besides, the volcano and the earthquake were raging on this earth with as much, nay greater violence, thousands and thousands of years before man set foot upon it. But perhaps, on the other hand, it may have occurred to some to ask themselves whether it is not just possible that these ugly affairs are sent among us for some beneficent purposes; or at all events that they may form part and parcel of some great scheme of providential arrangement which is at work for good and not for ill.

INCIDENTAL CATASTROPHES.

A ship sometimes strikes on a rock, and all on board perish; a railway train runs into another, or breaks down, and then wounds and contusions are the order of the day; but nobody doubts that navigation and railway communication are great blessings. None of the great natural provisions for producing good are exempt in their workings from producing occasional mischief. Storms disperse and dilute pestilental vapors, and lightnings decompose and destroy them; but both the one and the other often annihilate the works of man, and inflict upon him sudden death.

Well, then, I think I shall be able to show that the volcano and the earthquake, dreadful as they are, as local and temporary visitations, are in fact unavoidable (I had almost said necessary) incidents in a vast system of action to which we owe the very ground we stand upon, the very land we inhabit, without which neither man, beast, nor bird would have a place for their existence, and the world would be the habitation of nothing but fishes.

Now, to make this clear, I must go a little out of my way and say something about the first principles of geology. Geology does not pretend to go back to the creation of the world, or concern itself about its primitive state, but it does concern itself with the changes it sees going on in it now, and with the evidence of a long series of such changes it can produce in the most unmistakable

features of the structure of our rocks and soil, and the way in which they lie one on the other.

As to what we see going on.—We see everywhere, and along every coast-line, the sea warring against the land, and everywhere overcoming it; wearing and eating it down, and battering it to pieces; grinding those pieces to powder; carrying the powder away, and spreading it out over its own bottom, by the continued effect of the tides and currents. Look at our chalk cliffs, which once, no doubt, extended across the Channel to the similar cliffs on the French coast.

What do we see? Precipices cut down to the sea-beach, constantly hammered by the waves and constantly crumbling: the beach itself made of the flints outstanding after the softer chalk had been ground down and washed away; themselves grinding one onother under the same ceaseless discipline; first rounded into pebbles, then worn into sand, and then carried out farther and farther down the slope, to be replaced by fresh ones from the same source.

PROCESSES GOING ON.

Well, the same thing is going on everywhere, round every coast of Europe, Asia, Africa and America. Foot by foot or inch by inch, month by month or century by century, down everything must go. Time is as nothing in geology. And what the sea is doing the river is helping it to do. Look at the sand-banks at the mouth of the Thames. What are they but the materials of our island carried out to sea by the stream? The Ganges carries away from the soil of India, and delivers into the sea, twice as much solid substance weekly as is contained in the great pyramid of Egypt. The Irawaddy sweeps off from Burmah sixty-two cubic feet of earth in every second of time on an average, and there are 86,400 seconds in every day, and 365 days in every year; and so on for the other rivers.

What has become of all that great bed of chalk which once covered all the weald of Kent, and formed a continuous mass from Ramsgate and Dover to Beechy Head, running inland to Madams-

court Hill and Seven Oaks? All clean gone, and swept out into the bosom of the Atlantic, and there forming other chalk-beds. Now, geology assures us, on the most conclusive and undeniable evidence, that all our present land, all our continents and islands have been formed in this way out of the ruins of former ones. The old ones which existed at the beginning of things have all perished, and what we now stand upon has most assuredly been, at one time or other, perhaps many times, the bottom of the sea.

Well, then, there is power enough at work, and it has been at work long enough utterly to have cleared away and spread over the bed of the sea all our present existing continents and islands, had they been placed where they are at the creation of the world; and from this it follows as clear as demonstration can make it, that without some process of renovation and restoration to act in antagonism to this destructive work of old Neptune, there would not now be remaining a foot of dry land for living thing to stand upon.

WERE HOISTED AT ONE BLOW.

Now, what is this process of restoration? Let the volcano and the earthquake tell their tale. Let the earthquake tell how, within the memory of man—under the eyesight of eye-witnesses, one of whom (Mrs. Graham) has described the fact—the whole coast line of Chili, for one hundred miles about Valparaiso, with the mighty chain of the Andes—mountains to which the Alps sink into insignificance—was hoisted at one blow (in a single night, Nov. 19, A. D. 1822) from two to seven feet above its former level, leaving the beach below the old water mark high and dry; leaving the shell-fish sticking on the rocks out of reach of water; leaving the seaweed rotting in the air, or rather drying up to dust under the burning sun of a coast where rain never falls.

The ancients had a fable of Titan hurled from heaven and buried under Etna, and by his struggles causing the earthquakes that desolated Sicily. But here we have an exhibition of Titanic forces on a far mightier scale. One of the Andes upheaved on this occasion was the gigantic mass of Aconagva, which overlooks Valparaiso. To bring home to the mind the conception of such

an effort, we must form a clear idea of what sort of mountain this is. It is nearly 24,000 feet in height.

Chimborazo, the loftiest of the volcanic cones of the Andes, is lower by 2,500 feet; and yet Etna, with Vesuvius at the top of it, and another Vesuvius piled on that, would little more than surpass the midway portion of the snow-covered portion of that cone, which is one of the many chimneys by which the hidden fires of the Andes fine vent. On the occasion I am speaking of, at least ten thousand square miles of country were estimated as having been upheaved, and the upheaval was not confined to the land, but extended far away to sea, which was proved by the soundings off Valparaiso and along the coast, having been found considerably shallower than they were before the shock.

Again, in the year 1819, in an earthquake in India, in the district of Cutch, bordering on the Indus, a tract of country more than fifty miles long and sixteen broad was suddenly raised ten feet above its former level. The raised portion still stands up above the unraised like a long perpendicular wall, which is known by the name of the "Ullah Bund," or "God's Wall."

GIGANTIC UPHEAVALS.

And again, in 1538, in that convulsion which threw up the Monte Nuovo (New Mountain), a cone of ashes 450 feet high, in a single night; the whole coast of Pozzuoli, near Naples, was raised twenty feet above its former level, and remains so permanently upheaved to this day. And I could mention innumerable other instances of the same kind.

This, then, is the manner in which the earthquake does its work; and it is always at work. Somewhere or other in the world, there is perhaps not a day, certainly not a month, without an earthquake. In those districts of South and Central America, where the great chain of volcanic cones is situated—Chimborazo, Cotopaxi, and a long list with names unmentionable, or at least unpronounceable—the inhabitants no more think of counting earthquake shocks than we do of counting showers of rain.

Indeed, in some places along the coast, a shower is a greater

rarity. Even in our own island, near Perth, a year seldom passes without a shock, happily, within the records of history, never powerful enough to do any mischief.

It is not everywhere that this process goes on by fits and starts. For instance, the northern gulfs, and borders of the Baltic Sea, are steadily shallowing; and the whole mass of Scandinavia including Norway, Sweden and Lapland, is rising out of the sea at the average rate of about two feet per century. But as this fact (which is perfectly well established by reference to ancient high and low water marks) is not so evidently connected with the action of earthquakes, I shall not refer to it just now.

All that I want to show is, that there is a great cycle of changes going on, in which the earthquake and volcano act a very conspicuous part, and that part a restorative and conservative one; in opposition to the steadily destructive and leveling action of the ocean waters.

CAUSES OF THE PHENOMENA.

How this can happen; what can be the origin of such an enormous power thus occasionally exerting itself, will no doubt seem very marvelous—little short, indeed, of miraculous intervention—but the mystery, after all, is not quite so great as at first seems. We are permitted to look a little way into these great secrets; not far enough, indeed, to clear up every difficulty, but quite enough to penetrate us with admiration of that wonderful system of counterbalances and compensations; that adjustment of causes and consequences, by which, throughout all nature, evils are made to work their own cure; life to spring out of death; and renovation to tread in the steps and efface the vestiges of decay.

The key to the whole affair is to be found in the central heat of the earth. This is no scientific dream, no theoretical notion, but a fact established by direct evidence up to a certain point, and standing out from plain facts as a matter of unavoidable conclusion, in a hundred ways.

We all know that when we go into a cellar out of a summer

sun it feels cool; but when we go into it out of a wintry frost it is warm. The fact is, that a cellar, or a well, or any pit of a moderate depth, has always, day and night, summer and winter, the same degree of warmth, the same temperature, as it is called; and that always and everywhere is the same, or nearly the same, as the average warmth of the climate of the place. Forty or fifty feet deep in the ground, the thermometer here in this spot, would always mark the same degree, 49°, that is, or seventeen degrees above the freezing point. Under the equator, at the same depth, it always stands at 84°, which is our hot summer heat, but which there is the average heat of the whole year.

And this is so everywhere. Just at the surface, or a few inches below it, the ground is warm in the daytime, cool at night; at two or three feet deep the difference of day and night is hardly perceptible, but that of summer and winter is considerable. But at forty or fifty feet this difference also disappears, and you find a perfectly fixed, uniform degree of warmth, day and night; summer and winter; year after year.

HOTTER AS WE GO DOWN.

But when we go deeper, as, for instance, down into mines or coal-pits, this one broad and general fact is always observed—everywhere, in all countries, in all latitudes, in all climates, wherever there are mines, or deep subterranean caves—the deeper you go, the hotter the earth is found to be. In one and the same mine, each particular depth has its own particular degree of heat, which never varies: but the lower always the hotter; and that not by a trifling, but what may well be called an astonishingly rapid rate of increase—about a degree of the thermometer additional warmth for every 90 feet of additional depth, which is about 58° per mile!—so that, if we had a shaft sunk a mile deep, we should find in the rock a heat of 105°, which is much hotter than the hottest summer day ever experienced

It is not everywhere, however, that it is worth while to sink a shaft to any great depth; but borings for water (in what are called Artesian wells) are often made to enormous depths, and the

water always comes up hot; and the deeper the boring, the hotter the water. There is a very famous boring of this sort in Paris, at La Grenelle. The water rises from a depth of 1794 feet, and its temperature is 82° of our scale, which is almost that of the equator. And, again, at Salzwerth, in Oeynhausen, in Germany, in a boring for salt springs 2144 feet deep, the salt water comes up with with a still higher heat, viz., 91°.

Then, again, we have natural hot water springs, which rise, it is true, from depths we have no means of ascertaining; but which, from the earliest recorded times, have always maintained the same heat. At Bath, for instance, the hottest well is 117° Fahr. On the Arkansas River, in the United States, is a spring of 180°, which is scalding hot; and that out of the neighborhood of any volcano.

MASS OF RED-HOT IRON.

Now, only consider what sort of a conclusion this lands us in. This globe of ours is 8000 miles in diameter; a mile deep on its surface is a mere scratch. If a man had twenty greatcoats on, and I found under the first a warmth of 60° above the external air, I should expect to find 60° more under the second, and 60° more under the third, and so on; and, within all, no man, but a mass of red-hot iron.

Just so with the outside crust of the earth. Every mile thick is such a greatcoat, and at twenty miles depth, according to this rate, the ground must be fully red-hot; and at no such very great depth beyond, either the whole must be melted, or only the most infusible and intractable kinds of material, such as our fireclays and flints, would present some degree of solidity.

In short, what the icefloes and icebergs are to the polar seas, so we shall come to regard our continents and mountain-ranges in relation to the ocean of melted matter beneath. I do not mean to say there is no solid central mass; there may be one, or there may not, and, upon the whole, I think it likely enough that there is—kept solid, in spite of the heat, by the enormous pressure; but that has nothing to do with the present argument.

All that I contend for is this.—Grant me a sea of liquid fire, on which we are all floating—land and sea ; for the bottom of the sea anyhow will not come nearly down to the lava level. The sea is probably nowhere more than five or six miles deep, which is far enough above that level to keep its bed from becoming red-hot.

Well, now, the land is perpetually wearing down, and the materials being carried out to sea. The coat of heavier matter is thinning off towards the land, and thickening over all the bed of the sea. What must happen ? If a ship float even on her keel, transfer weight from the starboard to her larboard side, will she continue to float even ? No, certainly. She will heel over to larboard. Many a good ship has gone to the bottom in this way. If the continents be lightened, they will rise ; if the bed of the sea receive additional weight, it will sink.

BOTTOM OF THE OCEAN SINKING.

The bottom of the Pacific is sinking, in point of fact. Not that the Pacific is becoming deeper. This seems a paradox ; but it is easily explained. The whole bed of the sea is in the act of being pressed down by the laying on of new solid substance over its bottom. The new bottom then is laid upon the old, and so the actual bed of the ocean remains at or nearly at the same distance from the surface water. But what becomes of the islands ? They form part and parcel of the old bottom ; and Dr. Darwin has shown, by the most curious and convincing proofs, that they are sinking, and have been sinking for ages, and are only kept above water—by what, think you? By the labors of the coral insects which always build up to the surface !

It is impossible but that this increase of pressure in some places and relief in others must be very unequal in their bearings. So that at some place or other this solid floating crust must be brought into a state of strain, and if there be a weak or soft part, a crack will at last take place. When this happens, down goes the land on the heavy side and up on the light side. Now this is exactly what took place in the earthquake which raised the Ullah Bund in Cutch.

I have told you of a great crack drawn across the country, not far from the coast line ; the inland country rose ten feet, but much of the sea-coast, and probably a large tract in the bed of the Indian Ocean, sank considerably below its former level. And just as you see when a crack takes place in ice, the water oozes up ; so this kind of thing is always, or almost always, followed by an upburst of the subterranean fiery matter. The earthquake of Cutch was terminated by the outbreak of a volcano at the town of Bhooi, which it destroyed.

Now where, following out this idea, should we naturally expect such cracks and outbreaks to happen? Why, of course, along those lines where the relief of pressure on the land side is the greatest, and also its increase on the sea side ; that is to say, along or in the neighborhood of the sea-coasts, where the destruction of the land is going on with most activity.

CLOSE TO THE COAST LINE.

Well, now, it is a remarkable fact in the history of volcanoes, that there is hardly an instance of an active volcano at any considerable distance from the sea cost. All the great volcanic chain of the Andes is close to the western coast line of America. Etna is close to the sea ; so is Vesuvius ; Teneriffe is very near the African coast ; Mount Erebus is on the edge of the great Antartic continent.

Out of 225 volcanoes which are known to be in actual eruption over the whole earth within the last 150 years, I remember only a single instance of one more than 320 miles from the sea, and that is on the edge of the Caspian, the largest of the inland seas —I mean Mount Demawend in Persia.

Suppose from this, or any other cause, a crack to take place in the crust of the earth. Don't imagine that the melted matter below will simply ooze up quietly, as water does from under an ice-crack. No such thing. There is an element in the case we have not considered ; steam and condensed gases. We all know what takes place in a high pressure steam-boiler, with what violence the contents escape, and what havoc takes place.

Now there is no doubt that among the minerals of the subterranean world, there is water in abundance, and sulphur, and many other vaporizable substances, all kept subdued and repressed by the enormous pressure. Let this pressure be relieved, and forth they rush, and the nearer they approach the surface the more they expand, and the greater is the explosive force they acquire; till at length, after more or fewer preparatory shocks, each accompanied with progressive weakening of the overlying strata, the surface finally breaks up, and forth rushes the imprisoned power, with all the awful violence or a volcanic eruption.

Certainly a volcano does seem to be a very bad neighbor; and yet it affords a compensation in the extraordinary richness of the volcanic soil, and the fertilizing quality of the ashes thrown out. The flanks of Somma (the exterior crater of Vesuvius) are covered with vineyards producing wonderful wine, and whoever has visited Naples, will not fail to be astonished at the productiveness of volcanized territory as contrasted with the barrenness of the limestone rocks bordering on it.

THREE CROPS AT ONCE.

There you will see the amazing sight (as an English farmer would call it) of a triple crop growing at once on the same soil; a vineyard, an orchard, and a cornfield all in one. A magnificent wheat crop, five or six feet high, overhung with clustering grapevines swinging from one apple or pear tree to another in the most luxuriant festoons! When I visited Somma, to see the country where the celebrated wine, the Lacryma Christi, is grown, it was the festival of Madonna del Arco. Her church was crowded to suffocation with a hot and dusty assemblage of the peasantry. The fine impalpable volcanic dust was everywhere; in your eyes, in your mouth, begriming every pore; and there I saw what I shall never forget. Jammed among the crowd, I felt something jostling my legs.

Looking down, and the crowd making way, I beheld a line of worshipers crawling on their hands and knees from the door of the church to the altar, licking the dusty pavement all the way

with their tongues, positively applied to the ground and no mistake. No trifling dose of Lacryma would be required to wash down what they must have swallowed on that journey, and I have no doubt it was administered pretty copiously after the penance was over.

Now I come to consider the manner in which an earthquake is propagated from place to place; how it travels, in short. It runs along the earth precisely in the same manner, and according to the same mechanical laws as a wave along the sea, or rather as the waves of sound run along the air, but quicker.

The earthquake which destroyed Lisbon ran out from thence, as from a centre, in all directions, at a rate averaging about twenty miles per minute, as far as could be gathered from a comparison of the time of its occurrence at different places; but there is little doubt that it must have been retarded by having to traverse all sorts of ground, for a blow or shock of any description is conveyed through the substance on which it is delivered with the rapidity of sound in that substance.

SOUND CONVEYED BY WATER.

Perhaps it may be new to many to be told that sound is conveyed by water, by stone, by iron, and indeed, by everything, and at a different rate for each. In air it travels at the rate of about 1140 feet per second, or about thirteen miles a minute. In water much faster, more than four times as fast (4700 feet). In iron ten times as fast (11,400 feet), or about 130 miles in a minute, so that a blow delivered endways at one end of an iron rod, 130 miles long, would only reach the other after a lapse of a minute, and a pull at one end of an iron wire of that length, would require a minute before it would be felt at the other.

But the substance of the earth through which the shock is conveyed is not only far less elastic than iron, but it does not form a coherent, connected body; it is full of interruptions, cracks, loose materials, and all of these tend to deaden and retard the shock; and putting together all the accounts of all the earthquakes that have been exactly observed, their rate of travel may

be taken to vary from as low as twelve or thirteen miles a minute to seventy or eighty; but perhaps the low velocities arise from oblique waves.

The way, then, that we may conceive an earthquake to travel is this—I shall take the case which is most common, when the motion of the ground to-and-fro is horizontal. How far each particular spot on the surface of the ground is actually pushed from its place there is no way of ascertaining, since all the surrounding objects receive the same impulse almost at the same instant of time, but there are many indications that it is often several yards.

GROUND SMITTEN BY TREES.

In the earthquake of Cutch, which I have mentioned, trees were seen to flog the ground with their branches, which proves that their stems must have been jerked suddenly away for some considerable distance and as suddenly pushed back; and the same conclusion follows from the sudden rise of the water of lakes on the side where the shock reaches them, and its fall on the opposite side; the bed of the lake has been jerked away for a certain distance from under the water and pulled back.

Now, suppose a row of sixty persons, standing a mile apart from each other, in a straight line, in the direction in which the shock travels; at a rate, we will suppose, of sixty miles per minute; and let the ground below the first get a sudden and violent shove, carrying it a yard in the direction of the next. Since this shock will not reach the next till after the lapse of one second of time, it is clear that the space between the two will be shortened by a yard, and the ground—that is to say, not the mere loose soil on the surface, but the whole mass of solid rock below, down to an unknown depth—compressed, or driven into a smaller space.

It is this compression that carries the shock forwards. The elastic force of the rocky matter, like a coiled spring acts both ways; it drives back the first man to his old place, and shoves the second a yard nearer the third, and so on. Instead of men place a row of tall buildings, or columns, and they will tumble down in

succession, the base flying forwards, and leaving the top behind to drop on the soil on the side from which the shock came.

This is just what has happened in Messina in the great Catlabrian earthquake. As the shock ran along the ground, the houses of the Faro were seen to topple down in succession; beginning at one end and running on to the other, as if a succession of mines had been sprung. In the earthquake in Cutch, a sentinel standing at one end of a long straight line of wall, saw the wall bow forward and recover itself; not all at once, but with a swell like a wave running all along it with immense rapidity.

In this case it is evident that the earthquake wave must have its front oblique to the direction of the wall (just as an obliquely-held rule runs along the edge of a page of paper while it advances, like a wave of the sea, perpendicularly to its own length).

CONCERNING EXTINCT VOLCANOES.

In reference to extinct volcanoes, I may just mention that any one who wishes to see some of the finest specimens in Europe may do so by making a couple of days' railway travel to Clermont, in the department of the Puy-de-Dome in France. There he will find a magnificent series of volcanic cones, fields of ashes, streams of lavas, and basaltic terraces of platforms, proving the volcanic action to have been continued for countless ages before the present surface of the earth was formed; and all so clear that he who runs may read their lesson. There can there be seen a configuration of surface quite resembling what telescopes show in the most volcanic districts of the moon. Let not my hearers be startled; half the moon's face is covered with unmistakable craters of extinct volcanoes.

Many of the lavas of Auvergne and the Puy-de-Dome are basaltic; that is, consisting of columns placed close together; and some of the cones are quite complete, and covered with loose ashes and cinders, just as Vesuvius is at this hour.

In the study of these vast and awful phenomena we are brought in contact with those immense and rude powers of nature which seem to convey to the imagination the impress of brute

force and lawless violence; but it is not so. Such an idea is not more derogatory to the wisdom and benevolence that prevails throughout all the scheme of creation than it is in itself erroneous. In their wildest paroxysms the rage of the volcano and the earthquake is subject to great and immutable laws: they feel the bridle and obey it.

The volcano bellows forth its pent-up overplus of energy and sinks into long and tranquil repose. The earthquake rolls away, and industry, that balm which nature knows how to shed over every wound, effaces its traces, and festoons its ruins with flowers. There is mighty and rough work to be accomplished, and it cannot be done by gentle means. It seems, no doubt, terrible, awful, perhaps harsh, that twenty or thirty thousand lives should be swept away in a moment by a sudden and unforeseen calamity; but we must remember that sooner or later every one of those lives must be called for, and it is by no means the most sudden end that is the most afflictive.

NATURE'S TREMENDOUS ENERGIES.

It is well too that we should contemplate occasionally, if it were only to teach us humility and submission, the immense energies which are everywhere at work in maintaining the system of nature we see going on so smoothly and tranquilly around us, and of which these furious outbreaks, after all, are but minute, and for the moment unbalanced surpluses in the great account. The energy requisite to overthrow a mountain is as a drop in the ocean compared with that which holds it in its place, and makes it a mountain. Chemistry tells us that the forces constantly in action to maintain a single grain of water in its habitual state, when only partially and sparingly let loose in the form of electricity, would manifest themselves as a powerful flash of lightning.

And we learn from optical science that in even the smallest element of every material body, nay, even in what we call empty space, there are forces in perpetual action to which even such energies sink into insignificance. Yet, amid all this, nature holds her even course: the flowers blossom; animals enjoy their

brief span of existence; and man has leisure and opportunity to contemplate and adore, secure of the watchful care which provides for his well-being at every instant that he is permitted to remain on earth.

The first great earthquake of which any very distinct knowledge has reached us is that which occurred in the year 63 after our Saviour, which produced great destruction in the neighborhood of Vesuvius, and shattered the cities of Pompeii and Herculaneum upon the Bay of Naples, though it did not destroy them. This earthquake is chiefly remarkable as having been the forerunner and the warning (if that warning could have been understood) of the first eruption of Vesuvius on record, which followed sixteen years afterwards in the year 79.

DID NOT KNOW IT WAS A VOLCANO.

Before that time none of the ancients had any notion of its being a volcano, though Pompeii itself is paved with its lava. The crater was probably filled, or at least the bottom occupied, by a lake; and we read of it as the stronghold of the rebel chief Spartacus, who, when lured there by the Roman army, escaped with his followers by clambering up the steep sides by the help of the wild vines that festooned them. The ground since the first earthquake in 63 had often been shaken by slight shocks, when at length, in August 79, they became more numerous and violent, and, on the night preceding the eruption, so tremendous as to threaten everything with destruction.

A morning of comparative repose succeeded, and the terrified inhabitants of those devoted towns no doubt breathed more freely, and hoped the worst was over, when, about one o'clock in the afternoon, the Elder Pliny, who was stationed in command of the Roman fleet at Misenum in full view of Vesuvius, beheld a huge black cloud ascending from the mountain, which, "rising slowly always higher," at last spread out aloft like the head of one of those picturesque flat-topped pines which form such an ornament of the Italian landscape.

The meaning of such a phenomenon was to Pliny and to

everyone a mystery. We know now too well what it imports, and they were not long left in doubt. From that cloud descended

TERRIFIC ERUPTION OF THE GREAT CRATER OF VESUVIUS.

stones, ashes, and pumice; and the cloud itself lowered down upon the surrounding country, involving land and sea in profound darkness, pierced by flashes of fire more vivid than lightning.

These, with the volumes of ashes that began to encumber the soil, and which covered the sea with floating pumice-stone; the constant heaving of the ground; and the sudden recoil of the sea, form a picture which is wonderfully well described by the the Younger Pliny. His uncle, animated by an eager desire to know what was going on, and to afford aid to the inhabitants of the towns, made sail for the nearest point of the coast and landed; but was instantly enveloped in the dense sulphureous vapor that swept down from the mountain, and perished miserably.

It does not seem that any lava flowed on that occasion. Pompeii was buried under the ashes; Herculaneum by a torrent of mud, probably the contents of the crater, ejected at the first explosion. This was most fortunate. We owe to it the preservation of some of the most wonderful remains of antiquity. For it is not yet much more than a century ago that, in digging a well at Portici near Naples, the Theatre of Herculaneum was discovered, some sixty feet under ground,—then houses, baths, statues, and, most interesting of all, a library full of books; and those books still legible, and among them the writings of some ancient authors which had never before been met with, but which have now been read, copied, and published, while hundreds and hundreds, I am sorry to say, still remain unopened.

Pompeii was not buried so deep; the walls of some of the buildings appeared among the modern vineyards, and led to excavations which were easy, the ashes being light and loose. And there you now may walk through the streets, enter the houses and find the skeletons of their inmates, some in the very act of trying to escape. Nothing can be more strange and striking.

Since that time Vesuvius has been frequently, but very irregularly, in eruption. The next after Pompeii was in the year 202, under Severus, and in 472 occurred an eruption so tremendous that all Europe was covered by the ashes, and even Constantinople thrown into alarm. This may seem to savor of the marvelous, but before I have done I hope to show that it is not beyond what we know of the power of existing volcanoes.

CHAPTER XIX.

GREAT VOLCANIC ERUPTIONS IN MANY PARTS OF THE WORLD. STORY OF MT. ETNA.—CONVULSIONS IN SOUTH AMERICA AND ELSEWHERE.

I SHALL not, of course, occupy attention with a history of Vesuvius, but pass at once to the eruption of 1779—one of the most interesting on record, from the excellent account given of it by Sir William Hamilton, who was then resident at Naples as our Minister, and watched it throughout with the eye of an artist as well as the scrutiny of a philosopher.

In 1767, there had been a considerable eruption, during which Pliny's account of the great pine-like, flat-topped, spreading mass of smoke had been superbly exemplified; extending over the Island of Capri, which is twenty-eight miles from Vesuvius. The showers of ashes, the lava currents, the lightnings, thunderings, and earthquakes were very dreadful; but they were at once brought to a close when the mob insisted that the head of St. Januarius should be brought out and shown to the mountain; and when this was done, all the uproar ceased on the instant, and Vesuvius became as quiet as a lamb!

He did not continue so, however, and it would have been well for Naples if the good Saint's head could have been permanently fixed in some conspicuous place in sight of the hill—for from that time till the year 1779 it never was quiet.

In the spring of that year it began to pour out lava; and on one occasion, when Sir William Hamilton approached too near, the running stream was on the point of surrounding him; and the sulphureous vapor cut off his retreat, so that his only mode of escape was to walk across the lava, which, to his astonishment, and, no doubt, to his great joy, he found accompanied with no difficulty, and with no more inconvenience than what proceeded from the radiation of heat on his legs and feet from the scoriæ and cinders with which the external crust of the lava was loaded:

and which in great measure intercepted and confined the glowing heat of the ignited mass below.

In such cases, and when cooled down to a certain point, the motion of the lava-stream is slow and creeping; rather rolling over itself than flowing like a river; the top becoming the bottom, owing to the toughness of the half-congealed crust. When it issues, however, from any accessible vent, it is described as perfectly liquid, of an intense white heat, and spouting or welling forth with extreme rapidity.

So Sir Humphrey Davy described it in an eruption at which he was present; and so Sir William Hamilton, in the eruption we are now concerned with, saw it "bubbling up violently" from one of its fountains on the slope of the volcano, "with a hissing and crackling noise, like that of an artificial firework; and forming, by the continual splashing up of the vitrified matter, a sort of dome or arch over the crevice from which it issued," which was all, internally, "red-hot like a heated oven."

RUMBLING NOISES AND EXPLOSIONS.

However, as time went on, this quiet mode of getting rid of its contents would no longer suffice, and the usual symptoms of more violent action—rumbling noises and explosions within the mountain; puffs of smoke from its crater, and jets of red-hot stones and ashes—continued till the end of July, when they increased to such a degree as to exhibit at night the most beautiful firework imaginable.

The eruption came to its climax from the 5th to the 10th of August, on the former of which days, after the ejection of an enormous volume of white clouds, piled like bales of the whitest cotton, in a mass exceeding four times the height and size of the mountain itself; the lava began to overflow the rim of the crater, and stream in torrents down the steep slope of the cone. This was continued till the 8th, when the great mass of the lava would seem to have been evacuated, and no longer repressing by its weight the free discharge of the imprisoned gases, allowed what remained to be ejected in fountains of fire, carried up to an

immense height in the air. The description of one of these I must give in the picturesque and vivid words of Sir William Hamilton himself.

"About nine o'clock," he says, on Sunday the 8th of August, "there was a loud report, which shook the houses at Portici and

NAPLES, SHOWING MOUNT VESUVIUS IN THE DISTANCE.

its neighborhood to such a degree as to alarm the inhabitants and drive them out into the streets. Many windows were broken, and as I have since seen, walls cracked by the concussion of the air from that explosion. In one instant a fountain of liquid transparent fire began to rise, and gradually increasing, arrived at so amazing a height as to strike every one who beheld it with the most awful astonishment. I shall scarcely be credited when I

assure you that, to the best of my judgment, the height of this stupendous column of fire could not be less than three times that of Vesuvius itself; which, you know, rises perpendicularly near 3,700 feet above the level of the sea." (The height of my own measurement in 1824 is 3,920 feet.)

"Puffs of smoke, as black as can possibly be imagined, succeeded one another hastily, and accompanied the red-hot, transparent, and liquid lava, interrupting its splendid brightness here and there by patches of the darkest hue. Within these puffs of smoke, at the very moment of their emission from the crater, I could perceive a bright but pale electrical fire playing about in zigzag lines.

THROWN UPWARD THOUSANDS OF FEET.

"The liquid lava, mixed with scoriæ and stones, after having mounted, I veritably believe at least 10,000 feet, falling perpendicularly on Vesuvius, covered its whole cone, part of that of Somma, and the valley between them. The falling matter being nearly as vivid and inflamed as that which was continually issuing fresh from the crater, formed with it one complete body of fire, which could not be less than two miles and a half in breadth, and of the extraordinary height above mentioned; casting a heat to the distance of at least six miles around it.

"The brushwood of the mountain of Somma was soon in flame, which, being of a different tint from the deep red of the matter thrown out from the volcano, and from the silvery blue of the electrical fire, still added to the contrast of this most extraordinary scene. After the column of fire had continued in full force for nearly half an hour, the eruption ceased at once, and Vesuvius remained sullen and silent."

The lightnings here described arose evidently in part from the chemical activity of gaseous decompositions going forward, in part to the friction of steam, and in part from the still more intense friction of the dust, stones and ashes encountering one another in the air, in analogy to the electric manifestations which accompany the dust storms in India.

To give an idea of the state of the inhabitants of the country when an explosion is going on, I will make one other extract:—"The mountain of Somma, at the foot of which Ottaiano is situated, hides Vesuvius from its sight, so that, until the eruption became considerable, it was not visible to them. On Sunday night, when the noise increased and the fire began to appear above the mountain of Somma, many of the inhabitants of the town flew to the churches, and others were preparing to quit the town, when a sudden violent report was heard, soon after which they found themselves involved in a thick cloud of smoke and minute ashes; a horrid clashing noise was heard in the air, and presently fell a deluge of stones and large scoriæ, some of which scoriæ were of the diameter of seven or eight feet, and must have weighed more than one hundred pounds before they were broken by their falls, as some of the fragments of them which I picked up in the streets still weighed upwards of sixty pounds.

GLEAMING SPARKS OF FIRE.

"When the large vitrified masses either struck against each other in the air or fell on the ground, they broke in many pieces, and covered a large space around them with vivid sparks of fire, which communicated their heat to everything that was combustible. In an instant the town and country about it was on fire in many parts; for in the vineyards there were several straw huts which had been erected for the watchmen of the grapes, all of which were burnt. A great magazine of wood in the heart of the town was all in a blaze, and had there been much wind, the flames must have spread universally, and all the inhabitants would have infallibly been burnt in their houses, for it was impossible for them to stir out.

"Some who attempted it with pillows, tables, chairs, tops of wine casks, etc., on their heads, were either knocked down or driven back to their close quarters under arches or in the cellars of the houses. Many were wounded, but only two persons have died of the wounds they received from this dreadful volcanic shower. To add to the horror of the scene, incessant volcanic lightning was

writhing about the black cloud that surrounded them, and the sulphurous smell and heat would scarcely allow them to draw their breath."

The next volcano I shall introduce is Ætna, the grandest of all our European volcanoes. I ascended it in 1824, and found its height by a very careful barometric measurement to be 10,772 feet above the sea, which, by the way, agrees within some eight or ten feet with Admiral Smyth's measurement.

The scenery of Ætna is on the grandest scale. Ascending from Catania you skirt the stream of lava which destroyed a part of that city in 1669, and which ran into the sea, forming a jetty or breakwater that now gives Catania what it never had before, the advantage of a harbor. There it lies as hard, rugged, barren, and fresh-looking as if it had flowed but yesterday. In many places it is full of huge caverns; great air-bubbles, into which one may ride on horseback (at least large enough) and which communicate, in a succession of horrible vaults, where one might wander and lose one's self without hope of escape.

BRISTLING WITH SMALL VOLCANOES.

Higher up, near Nicolosi, is the spot from which that lava flowed. It is marked by two volcanic cones, each of them a considerable mountain, called the Monti Rossi, rising 300 feet above the slope of the hill, and which were thrown up on that occasion. Indeed, one of the most remarkable features of Ætna is that of its flanks bristling over with innumerable smaller volcanoes. For the height is so great that the lava now scarcely ever rises to the top of the crater; for before that, its immense weight breaks through at the sides.

In one of the eruptions that happened in the early part of the century, I forget the date, but I think it was in 1819, and which was described to me on the spot by an eye-witness—the Old Man of the Mountain, Mario Gemellaro—the side of Ætna was rent by a great fissure or crack, beginning near the top, and throwing out jets of lava from openings fourteen or fifteen in number all the way down, so as to form a row of fiery fountains rising from dif-

ferent levels, and all ascending nearly to the same height : thereby proving them all to have originated in the great internal cistern as it were, the crater being filled up to the top level.

From the summit of Ætna extends a view of extraordinary magnificence. The whole of Sicily lies at your feet, and far beyond it are seen a string of lesser volcanoes; the Lipari Islands, between Sicily and the Italian coast ; one of which, Stromboli, is always in eruption, unceasingly throwing up ashes, smoke, and liquid fire.

But I must not linger on the summit of Ætna. We will now take a flight thence, all across Europe, to Iceland—a wonderful land of frost and fire. It is full of volcanoes, one of which, Hecla, has been twenty-two times in eruption within the last 800 years. Besides Hecla, there are five others, from which in the same period twenty eruptions have burst forth, making about one every twenty years. The most formidable of these was that which happened in 1783, a year also memorable as that of the terrible earthquake in Calabria. In May of that year, a bluish fog was observed over the mountain called Skaptur Jokul, and the neighborhood was shaken by earthquakes.

DARKENED THE WHOLE COUNTRY.

After a while a great pillar of smoke was observed to ascend from it, which darkened the whole surrounding district, and descended in a whirlwind of ashes. On the 10th of May, innumerable fountains of fire were seen shooting up through the ice and snow which covered the mountain ; and the principal river, called the Skapta, after rolling down a flood of foul and poisonous water, disappeared.

Two days after, a torrent of lava poured down into the bed which the river had deserted. The river had run in a ravine, 600 feet deep and 200 broad. This the lava entirely filled ; and not only so, but it overflowed the surrounding country, and ran into a great lake, from which it instantly expelled the water in an explosion of steam. When the lake was fairly filled, the lava again overflowed and divided into two streams, one of which covered some

ancient lava fields; the other re-entered the bed of the Skapta lower down; and presented the astounding site of a cataract of liquid fire pouring over what was formerly the waterfall of Stapafoss.

This was the greatest eruption on record in Europe. It lasted in its violence till the end of August, and closed with a violent earthquake; but for nearly the whole year a canopy of cinder-laden cloud hung over the island; the Faroe Islands, nay, even Shetland and the Orkneys, were deluged with the ashes; and volcanic dust and a preternatural smoke, which obscured the sun, covered all Europe as far as the Alps, over which it could not rise.

GREAT DESTRUCTION OF LIFE.

It has been surmised that the great Fireball of August 18, 1783, which traversed all England, and the Continent, from the North Sea to Rome, by far the greatest ever known (for it was more than half a mile in diameter), was somehow connected with the electric excitement of the upper atmosphere produced by this enormous discharge of smoke and ashes. The destruction of life in Iceland was frightful; 9000 men, 11,000 cattle, 28,000 horses and 190,000 sheep perished: mostly by suffocation. The lava ejected has been computed to have amounted in volume to more than twenty cubic miles.

We shall now proceed to still more remote regions, and describe, in as few words as may be, two immense eruptions—one in Mexico, in the year 1759; the other in the Island of Sumbawa in the Eastern Archipelago, in 1815.

I ought to mention, by way of preliminary, that almost the whole line of coast of South and Central America, from Mexico southwards as far as Valparaiso—that is to say, nearly the whole chain of the Andes—is one mass of volcanoes. In Mexico and Central America there are two and twenty, and in Quito, Peru, and Chili, six and twenty more, in activity; and nearly as many more extinct ones, any one of which may at any moment break out afresh. This does not prevent the country from being inhabited, fertile and well cultivated.

Well: in a district of Mexico celebrated for the growth of the finest cotton, between two streams called Cuitimba and San Pedro, which furnished water for irrigation, lay the farm and homestead of Don Pedro de Jurullo, one of the richest and most fertile properties in that country. He was a thriving man and lived in comfort as a large proprietor, little expecting the mischief that was to befall him.

In June 1759, however, a subterranean noise was heard in this peaceful region. Hollow sounds of the most alarming nature were succeeded by frequent earthquakes, succeeding one another for fifty or sixty days; but they died away, and in the beginning of September everything seemed to have returned to its usual state of tranquillity. Suddenly, on the night of the 28th of September, the horrible noises recommenced. All the inhabitants fled in terror, and the whole tract of ground, from three to four square miles in extent, rose up in the form of a bladder to a height of upwards of 500 feet.

IMMENSE TORRENT OF BOILING MUD.

Flames broke forth over a surface of more than half a square league, and through a thick cloud of ashes illuminated by this ghastly light, the refugees, who had ascended a mountain at some distance, could see the ground as if softened by the heat, and swelling and sinking like an agitated sea. Vast rents opened in the earth, into which the two rivers I mentioned precipitated themselves, but so far from quenching the fires, only seemed to make them more furious. Finally, the whole plain became covered with an immense torrent of boiling mud, out of which sprang thousands of little volcanic cones called Hornitos, or ovens.

But the most astonishing part of the whole was the opening of a chasm vomiting out fire, and red-hot stones and ashes, which accumulated so as to form "a range of six large mountain masses, one of which is upwards of 1600 feet in height above the old level, and which is now known as the volcano of Jurullo. It is continually burning, and for a whole year continued to throw up

an immense quantity of ashes, lava and fragments of rock. The roofs of houses at the town or village of Queretaro, upwards of 140 miles distant, were covered with the ashes.

The two rivers have again appeared, issuing at some distance from among the hornitos, but no longer as sources of wealth and fertility, for they are scalding hot, or at least were so when Baron Humboldt visited them several years after the event. The ground even then retained a violent heat, and the hornitos were pouring forth columns of steam twenty or thirty feet high, with a rumbling noise like that of a steam boiler.

The island of Sumbawa is one of that curious line of islands which links on Australia to the southeastern corner of Asia. It forms, with one or two smaller volcanic islands, a prolongation of Java, at that time, in 1815, a British possession, and under the government of Sir Stamford Raffles, to whom we owe the account of the eruption, and who took a great deal of pains to ascertain all the particulars. Java itself, I should observe, is one rookery of volcanoes, and so are all the adjoining islands in that long crescent-shaped line I refer to.

EXTRAORDINARY ERUPTION.

On the island of Sumbawa is the volcano of Tomboro, which broke out into eruption on the 5th of April in that year, and I can hardly do better than quote the account of it in Sir Stamford Raffles' own words:

"Almost every one," says this writer, "is acquainted with the intermitting convulsions of Etna and Vesuvius as they appear in the descriptions of the poet, and the authentic accounts of the naturalist; but the most extraordinary of them can bear no comparison, in point of duration and force, with that of Mount Tomboro in the island of Sumbawa! This eruption extended perceptible evidences of its existence over the whole of the Molucca Islands, over Java, a considerable portion of the Celebes Sumatra and Borneo, to a circumference of 1000 statute miles from its centre" (i. e., to 1000 miles distance), "by tremulous motions and the report of explosions.

"In a short time the whole mountain near the Sang'ir appeared like a body of liquid fire, extending itself in every direction. The fire and columns of flame continued to rage with unabated fury until the darkness, caused by the quantity of falling matter, obscured it about 8 P. M. Stones at this time fell very thick at Sang'ir, some of them as large as two fists, but generally not larger than walnuts. Between 9 and 10 P. M. ashes began to fall, and soon after a violent whirlwind ensued, which blew down nearly every house of Sang'ir, carrying the roofs and light parts away with it.

HUGE TREES TORN UP.

"In the port of Sang'ir, adjoining Sumbawa, its effects were much more violent, tearing up by the roots the largest trees, and carrying them into the air, together with men, horses, cattle, and whatsoever came within its influence. This will account for the immense number of floating trees seen at sea. The sea rose nearly twelve feet higher than it had ever been known to do before, and completely spoiled the only small spots of rice land in Sang'ir, sweeping away houses and everything within its reach. The whirlwind lasted about an hour. No explosions were heard until the whirlwind had ceased at about 11 P. M. From midnight till the evening of the 11th they continued without intermission; after that time their violence moderated and they were heard only at intervals; but the explosions did not cease entirely until the 15th of July.

"Of all the villages round Tomboro, Tempo, containing about forty inhabitants, is the only one remaining. In Pekaté no vestige of a house is left; twenty-six of the people, who were at Sumbawa at the time, are the whole of the population who have escaped. From the best inquiries, there were certainly not fewer than 12,000 individuals in Tomboro and Pekaté at the time of the eruption, of whom five or six survive.

"The trees and herbage of every description along the whole of the north and west of the peninsula, have been completely destroyed, with the exception of a high point of land near the spot

where the village of Tomboro stood. At Sang'ir, it is added, the famine occasioned by this event was so extreme, that one of the rajah's own daughters died of starvation.

"I have seen it computed that the quantity of ashes and lava vomited forth in this awful eruption would have formed three mountains the size of Mont Blanc, the highest of the Alps; and if spread over the surface of Germany, would have covered the whole of it two feet deep. The ashes did actually cover the whole island of Tombock, more than one hundred miles distant, to that depth, and 44,000 persons there perished by starvation, from the total destruction of all vegetation.

LAKE OF MOLTEN LAVA.

"The mountain Kirauiah, in the island of Owyhee, one of the Sandwich Isles, exhibits the remarkable phenomenon of a lake of molten and very liquid lava always filling the bottom of the crater, and always in a state of terrific ebullition, rolling to and fro its fiery surge and flaming billows—yet with this it is content, for it would seem that at least for a long time past there has been no violent outbreak so as to make what is generally understood by a volcanic eruption.

"Volcanic eruptions are almost always preceded by earthquakes, by which the beds of rock, that overlie and keep down the struggling powers beneath, are dislocated and cracked, till at last they give way, and the strain is immediately relieved. It is chiefly when this does not happen, when the force below is sufficient to heave up and shake the earth, but not to burst open the crust, and give vent to the lava and gases, that the most destructive effects are produced.

"The great earthquake of November 1, 1755, which destroyed Lisbon, was an instance of this kind, and was one of the greatest, if not the very greatest on record; for the concussion extended over all Spain and Portugal—indeed, over all Europe, and even into Scotland—over North Africa, where in one town in Morocco 8000 or 10,000 people perished. Nay, its effects extended even across the Atlantic to Madeira, where it was very violent; and to

the West Indies. The most striking feature about this earthquake was its extreme suddenness.

"All was going on quite as usual in Lisbon the morning of that memorable day, the weather fine and clear, and nothing whatever to give the population of that great capital the least suspicion of mischief. All at once, at twenty minutes before 10 A. M., a noise was heard like the rumbling of carriages under ground; it increased rapidly and became a succession of deafening explosions like the loudest cannon. Then a shock, which, as described by one writing from the spot, seemed to last but the tenth part of a minute, and down came tumbling palaces, churches, theatres, and every large public edifice, and about a third or a fourth part of the dwelling houses.

More shocks followed in succession, and in six minutes from the commencement 60,000 persons were crushed in the ruins! Here are the simple but expressive words of one J. Latham, who writes to his uncle in London. "I was on the river with one of my customers going to a village three miles off. Presently the boat made a noise as if on the shore or landing, though then in the middle of the water. I asked my companion if he knew what was the matter. He stared at me, and looking at Lisbon, we saw the houses falling, which made him say, 'God bless us, it is an earthquake!' About four or five minutes after, the boat made a noise as before, and we saw the houses tumble down on both sides of the river." They then landed and made for a hill, whence they beheld the sea (which had at first receded and laid a great tract dry) come rolling in, in a vast mountain wave fifty or sixty feet high, on the land, and sweeping all before it.

Three thousand people had taken refuge on a new stone quay just completed at great expense. In an instant it was turned topsy-turvy, and the whole quay, and every person on it, with all the vessels moored to it, disappeared, and not a vestige of them ever appeared again. Where that quay stood, was afterwards found a depth of 100 fathoms (600 feet) of water. It happened to be a religious festival, and most of the population were assembled in the churches, which fell and crushed them. That no horror

might be wanting, fires broke out in innumerable houses where wood-work had fallen on the fires, and much that the earthquake had spared was destroyed by fire.

"And then, too, broke forth that worst of all scourges, a lawless ruffian-like mob, who plundered, burned, and murdered in the midst of all that desolation and horror. The huge wave I have spoken of swept the whole coast of Spain and Portugal. Its swell and fall was ten or twelve feet at Madeira. It swept quite across the Atlantic, and broke on the shores of the West Indies. Every lake and firth in England and Scotland was dashed for a moment out of its bed, the water not partaking of the sudden shove given to the land, just as when you splash a flat saucerful of water, the water dashes over on the side from which the shock is given.

One of the most curious incidents in this earthquake was its effect on ships far out at sea, which would lead us to suppose that the immediate impulse was in the nature of a violent blow or thrust upward, under the bed of the ocean. Thus it is recorded that this upward shock was so sudden and violent on a ship, at that time forty leagues from Cape St. Vincent, that the sailors on deck were tossed up into the air to a height of eighteen inches.

MAINMAST SPLIT BY A BLOW.

"So also, on another occasion, in 1796, a British ship eleven miles from land near the Philippine Islands was struck upwards from below with such force as to unship and split up the mainmast.

"Evidences of a similar sudden and upward explosive action are of frequent occurrence among the extinct volcanoes of Auvergne and the Vivarais, where in many instances the perforation of the granitic beds which form the basis or substatum of the whole country appears to have been affected at a single blow, accompanied with little evidence of disturbance of the surrounding rocks—much in the same way as a bullet will pass through a pane of glass without starring or shattering it.

"In such cases it would seem as if water in a liquid state

had suddenly been let in through a fissure upon a most intensely heated and molten mass beneath, producing a violent but local explosion so instantaneous as to break its way through the overlying rocks, without allowing time for them to bend or crumple, and so displace the surrounding masses.

"The same kind of upward bounding movemement took place at Riobambo in Quito in the great earthquake of February 4, 1797, which was connected with an eruption of the volcano of Tunguragua. That earthquake extended in its greatest intensity over an oval space of 120 miles from south to north, and 60 from east to west, within which space every town and village was levelled with the ground; but the total extent of surface shaken was upward of 500 miles in one direction (from Puna to Popayan), and 400 in the other. Quero, Riobamba, and several other towns, were buried under fallen mountains, and in a very few minutes 30,000 persons were destroyed. At Riobamba, however, after the earthquake, a great number of corpses were found to have been tossed across a river, and scattered over the slope of a hill on the other side.

EARTH SHAKING VIOLENTLY.

"The frequency of these South American earthquakes is not more extraordinary than the duration of the shocks. Humboldt relates than on one occasion, when traveling on mule-back with his companion Bonpland, they were obliged to dismount in a dense forest, and throw themselves on the ground; the earth being shaken uninterruptedly for upwards of a quarter of an hour with such violence that they could not keep their legs.

"One of the most circumstantially described earthquakes on record is that which happened in Calabria on the 5th of February, 1783; I should say began then, for it may be said to have lasted four years. In the year 1783, for instance, 949 shocks took place, of which 501 were great ones, and in 1784, 151 shocks were felt, ninety-eight of which were violent. The centre of action seemed to be under the towns of Monteleone and Oppido.

"In a circle twenty-two miles in radius round Oppido every town and village was destroyed within two minutes by the first

shock, and within one of seventy miles radius all were seriously shaken and much damage done. The whole of Calabria was affected, and even across the sea Messina was shaken, and a great part of Sicily.

"There is no end of the capricious and out-of-the-way accidents and movements recorded in this Calabrian earthquake. The ground undulated like a ship at sea. People became actualy sea-sick, and to give an idea of the undulation (just as it happens at sea), the scud of the clouds before the wind seemed to be fitfully arrested during the pitching movement when it took place in the same direction and to redouble its speed in the reverse movement.

HOUSES ENTOMBED.

"At Oppido many houses were swallowed up bodily. Loose objects were tossed up several yards into the air. The flagstones in some places were found after a severe shock all turned bottom upwards. Great fissures opened in the earth, and at Terra Nova a mass of rock 200 feet high and 400 feet in diameter traveled four miles down a ravine. All landmarks were removed, and the land itself, in some instances, with trees and hedges growing on it, carried bodily away and set down in another place.

"Altogether about 40,000 people perished by the earthquakes, and some 20,000 more of the epidemic diseases produced by want and the effluvia of the dead bodies.

"Volcanoes occasionally break forth at the bottom of the sea, and, when this is the case, the result is usually the production of a new island. This, in many cases, disappears soon after it's formation, being composed of loose and incoherent materials which easily yield to the destructive power of the waves. Such was the case with the Island of Sabrina, thrown up in 1811, off St. Michael's, in the Azores, which disappeared almost as soon as formed, and in that of Pantellaria, on the Sicilian coast, which resisted longer, but was gradually washed into a shoal, and at length has, we believe, completely disappeared.

"In numerous other instances, the cones of cinders and scoriæ, once raised, have become compacted and bound together

by the effusion of lava, hardening into solid stone, and thus, becoming habitual volcanic vents, they continue to increase in height and diameter, and assume the importance of permanent volcanic islands. Such has been, doubtless, the history of those numerous insular volcanoes which dot the ocean in so many parts of the world such as Teneriffe, the Azores, Ascension, St. Helena, Tristan d'Acunha, etc.

"In some cases the process has been witnessed from its commencement, as in that of two islands which arose in the Aleutian group connecting Kamschatka with North America, the one in 1796, the other in 1814, and which both attained the elevation of 3000 feet.

VOLCANIC ACTION IN OCEANS.

"Besides these evident instances of eruptive action, there is every reason to believe that enormous floods of lava have been, at various remote periods in the earth's history, poured forth at the bottom of the seas so deep as to repress, by the mere weight of water, all outbreak of steam, gas, or ashes; and reposing perhaps for ages in a liquid state, protected from the cooling action of the water on their upper surface by a thick crust of congealed stony matter, to have assumed a perfect level; and, at length, by slow cooling, taken on that peculiar columnar structure which we see produced in minature in starch by the contraction or shrinkage, and consequent splitting, of the material in drying; and resulting in those picturesque and singular landscape features called basaltic colonnades: when brought up to-day by sudden or gradual upheaval, and broken into cliffs and terraces by the action of waves, torrents, or weather. Those grand specimens of such colonnades which Britain possesses in the Giant's Causeway of Antrim, and the cave of Fingal, in Staffa, for instance, are no doubt extreme outstanding portions of such a vast submarine lava-flood which at some inconceivably remote epoch occupied the whole intermediate space; affording the same kind of evidence of a former connection of the coasts of Scotland and Ireland as do the opposing chalk cliffs of Dover and Boulogne of the ancient connection of France with Britain. Here and there a small basaltic

island, such as that of Rathlin, remains to attest this former continuity, and to recall to the contemplative mind that sublime antagonism between sudden violence and persevering effort, which the study of geology impresses in every form of repetition.

"There exists a very general impression that earthquakes are preceded and ushered in by some kind of preternatural, and,

NEAR VIEW OF A VOLCANIC CRATER IN SOUTH AMERICA.

as it were, expectant calm in the elements; as if to make the confusion and desolation they create the more impressive. The records of such visitations which we possess, however striking some particular cases may appear, by no means bear out this as a general fact, or go to indicate any particular phase of weather as preferentially accompanying their occurrence.

"This does not prevent, however, certain conjunctures of atmospheric or other circumstances from exercising a determining

influence on the times of their occurrence. According to the view we have taken of their origin (viz., the displacement of pressure, resulting in a state of strain in the strata at certain points, gradually increasing to the maximum they can bear without disruption), it is the last ounce which breaks the camel's back. Great barometrical fluctuation, accumulating atmospheric pressure for a time over the sea, and relieving it over the land; an unusually high tide, aided by the long-continued and powerful winds heaping up the water; nay, even the tidal action of the sun and moon on the solid portion of the earth's crust—all these causes, for the moment combining, may very well suffice to determine the instant of fracture, when the balance between the opposing forces is on the eve of subversion.

"The last-mentioned cause may need a few words of explanation. The action of the sun and moon, though it cannot produce a tide in the solid crust of the earth, tends to do so, and, were it fluid, would produce it. It, therefore, in point of fact, does bring the solid portions of the earth's surface into a state alternately of strain and compression.

"The effective part of their force, in the present case, is not that which aids to lift or to press the superficial matter (for that acting alike on the continents and on the bed of the sea, would have no influence), but that which tends to produce lateral displacement; or what geometers call the tangential force. This of necessity brings the whole ring of the earth's surface, which at any instant has the acting luminary on its horizon, into a state of strain; and the whole area over which it is nearly vertical, into one of compression. We leave this point to be further followed out, but we cannot forbear remarking, that the great volcanic chains of the world have, in point of fact, a direction which this cause of disruption would tend rather to favor than to contravene.

CHAPTER XX.

ERUPTION OF ETNA IN THE YEAR 1865.—MUTUAL DEPENDENCE OF ALL TERRESTRIAL PHENOMENA.—SEA COAST LINE OF VOLCANOES.—THE PACIFIC "CIRCLE OF FIRE."

THE Greek mythology, harmonizing in this respect with the ideas of most nations which were acquainted with volcanoes, attributed to these mountains an origin altogether independent of the forces which are in action on the surface of the ground. According to the views of the Hellenes, water and fire were two distinct elements, and each had its separate domain, its genii, and its gods. Neptune reigned over the sea; it was he that unchained the storms and caused the waves to swell. The tritons followed in his train; the nymphs, sirens, and marine monsters obeyed his orders, and in the mountain valleys, the solitary naiads poured out to his honor the murmuring water from their urns. In the dark depth of unknown abysses was enthroned the gloomy Pluto; at his side Vulcan; surrounded by Cyclops, forged thunderbolts at his resounding anvil, and from their furnaces escaped all the flames and molten matter the appearance of which so appalled mankind. Between the gods of water and of fire there was nothing in common, except that both were the sons of Chronos, that is, of Time, which modifies every thing, which destroys and renews, and, by its incessant work of destruction, makes ready a place for the innumerable germs of vitality which crowd on the threshold of life.

Even in our days, the common opinion is not much at variance with these mythological ideas, and volcanic phenomena are looked upon as events of a character altogether different from other facts of terrestrial vitality. The latter, the sudden changes of which are visible and easily to be observed, are justly considered to be owing principally to the position of the earth in respect to the sun and the alternations of light and darkness, heat and cold, dryness and moisture, which necessarily result.

As regards volcanoes, on the contrary, an order of entirely distinct facts is imagined, caused by the gradual cooling of the planet or the unequal tides of an ocean of lava and fire. Certainly, the eruptions of ashes and incandescent matter have not revealed the mystery of their formation, and in this respect numerous problems still remain unsolved by scientific men. Nevertheless, the facts already known warrant us in asserting that volcanic crises are connected, like all other planetary phenomena, with the general causes which determine the continual changes of continents and seas, the erosion of mountains, the courses of rivers, winds, and storms, the movements of the ocean, and all the innumerable modifications which are taking place on the globe.

ORIGIN OF VOLCANOES.

If, some day, we are to succeed in pointing out exactly and plainly how volcanoes likewise obey, either partially or completely, the system of laws which govern the exterior of the globe, the first and most important requisite is to observe with the greatest care all the incidents of volcanic origin. When all the premonitory signs and all the products of eruptions shall have been perfectly ascertained and duly classified, then the glance of science will be on the point of penetrating into, and duly reading, the secrets of the subterranean abysses where these marvelous convulsions are being prepared.

The last great eruption of Etna, that central pyramid of the Mediterranean, which the ancients named the "Umbilicus of the world," is one of the most magnificent examples which can be brought forward of volcanic phenomena; and as it has, moreover, been studied most precisely and completely, it well deserves to be described in some detail.

The explosion had been heralded for some long time by precursory signs. In the month of July, 1863, after a series of convulsive movements of the soil, the loftiest cone of the volcano opened on the side which faces the south. The incandescent matter descended slowly over the plateau on which stands the "Maison des Anglais:" and this building itself was demolished

by the lumps of lava which were hurled from the mouth of the crater. In some places heaps of ashes several yards thick covered the slopes of the volcano.

After this first explosion, the mountain never became completely calm; numerous fissures, which opened on the outer slopes of the crater, continued to smoke, and the hot vapor never ceased to jet out from the summit in thick eddies. Often, indeed, during the night, the reflection of the lava boiling up in the central cavity lighted up the atmosphere with a fiery red. The liquid, being unable to rise to the mouth of the crater, pressed against the external walls of the volcano, and sought to find an issue through the weakest point of the crust by melting gradually the rocks that opposed its passage.

GROUND RENT ASUNDER.

Finally, in the night of the 30th to the 31st of January, 1865, the wall of the crater yielded to the pressure of the lava; some subterranean roaring was heard; slight agitations affected the whole of the eastern part of Sicily, and the ground was rent open for the length of a mile and a half to the north of Monte Frumento, one of the secondary cones which rise on the slope of Etna. Through this fissure, which opened on a gently-inclined plateau, the pent-up lava violently broke through to the surface.

The fissure which opened on the side of the mountain, and could be easily followed by the eye to a point about two-thirds of the height of Monte Frumento, in the direction of the terminal crater of Etna, seems to have vomited out lava but for a very few hours. Being soon obstructed by the snow and debris of the adjacent slopes, it ceased to retain its communication with the interior of the mountain, and now resembled a kind of furrow, as if hollowed out by the rain-water on the side of the cone. On the 31st of January all the volcanic activity of the crevice was concentrated on the gently inclined plateau which extends at the base of Monte Frumento, in the midst of which several new hillocks made their appearance.

On the lower prolongation of the line of fracture, all the

phenomena of the eruption properly so-called were distributed in a perfectly regular way. Six principal cones of ejection were raised above the crevice, and gradually increased in size, owing to the debris which they threw out of their craters. These, gradually mingling their intervening slopes, and blending them one with another, absorbed in succession other smaller cones which had been formed by their sides, thus reaching a height of nearly 300 feet. Soon after the commencement of the eruption the two upper craters, standing close together on an isolated cone, vomited nothing but lumps of stone and ashes, while jets of still liquid lava were emitted by the lower craters, which were arranged in a semi-circle around a sort of funnel-shaped cavity.

HOW LAVA MADE ITS ESCAPE.

In consequence of the specific gravities of the substances evacuated, a regular division of labor took place between the various points of the crevice. The projectiles which had solidified the triturated debris, and the more or less porous fragments which floated on the top of the lava, made their escape by the higher orifices; but the liquid mass, being heavier and more compact, could only burst forth from the ground by the mouths opening at a less elevation.

Two months after the commencement of the eruption, the cone which was the nearest to Frumento ceased to send out either scoriæ or ashes. The pipe of the crater was filled up with debris, and the internal activity was revealed by vapors either of a sulphurous character or charged with hydrochloric acid. These rose like smoke from the slope of the hillock. The second cone, situated on a lower part of the fissure, remained in direct communication with the central flow of lava; but it was not in a constant state of eruption, and rested after each effort as if to take breath. A crash like that of thunder was the forerunner of the explosion; clouds of vapor, rolling in thick folds, gray with ashes and furrowed with stones, darted out from the mouth of the volcano, darkening the atmosphere and throwing their projectiles over a radius of several hundreds of yards round the hillock.

Then, after having discharged their burdens of debris, the dark clouds, giving way to the pressure of the winds, mingled far and wide with the mists of the horizon. The lower cones, which rose immediately over the lava-source, continued to rumble and discharge molten matter outside their cavities. The vapor which escaped from the seething wall of lava crowded in dark contortions round the orifice of the craters. Some of it was red or yellow, owing to the reflection of the red-hot matter, and some was variously shaded by the trains of debris ejected with it; but it was impossible to follow them with the eye so rapid was their flight. An unintelligible tumult of harsh sounds simultaneously burst forth. They were like the noises of saws, whistles, and of hammers falling on an anvil. Sometimes one might have fancied it like the roaring of the waves breaking upon the rocks during a storm, if the sudden explosions had not added their thunder to all this uproar of the elements.

HILLS ROARING AND SMOKING.

One felt dismayed, as if before some living being, at the sight of these groups of hillocks, roaring and smoking, and increasing in size every hour, by the debris which they vomited forth from the interior of the earth. The volcano, however, then commenced to rest; the erupted matter did not rise much beyond 100 yards above the craters, while, according to the statement of M. Fouqué, at the commencement of the eruption it had been thrown to a height of 1850 to 1950 yards.

During the first six days the quantity of lava which issued from the fissure of Monte Frumento was estimated at 117 cubic yards a second, equivalent to a volume twice the bulk of the Seine at low-water time. In the vicinity of the outlets the speed of the current was not less than twenty feet a minute; but lower down, the stream, spreading over a wider surface, and throwing out several branches into the side valleys, gradually lost its initial speed, and the fringes of scoriæ, which were pushed on before the incandescent matter, advanced, on the average, according to the slope of the ground, not more than one and a half to six feet a minute.

On the second of February the principal current, the breadth of which varied from 300 to 550 yards, with an average thickness of forty-nine feet, reached the upper ledge of the escarpment of Colla-Vecchia, or Colla-Grande, three miles from the fissure of eruption, and plunged like a cataract into the gorge below. It was a magnificent spectacle, especially during the night, to see this sheet of molten matter, dazzling red like liquid iron, making its way, in a thin layer, from the heaps of brown scoriæ which had gradually accumulated up above; then, carrying with it the more solid lumps, which dashed one against the other with a metallic noise, it fell over into the ravine, only to rebound in stars of fire.

ITS BEAUTY FINALLY FADED.

But this splendid spectacle lasted only for a few days; the fiery fall, by losing in height, diminished gradually in beauty. In front of the cataract, and under the jet itself, there was formed an incessantly increasing slope of lava, which ultimately filled up the ravine, and, indeed, prolonged the slope of the valley above. From the reservoir, which was more than 160 feet deep, the stream continued to flow to the east toward Mascali, filling up to the brink the winding gorge of a dried up rivulet.

By the middle of the month of February, the fiery stream, already more than six miles long, made but very slow progress, and the still liquid lava found it difficult to clear an outlet through the crust of stones cooled by their contact with the atmosphere; when, all of a sudden, a breaking out took place at the side of the stream, at a point some distance up, not far from the source. Then a fresh branch of the burning river, flowing toward the plains of Linguagrossa, swallowed up thousands of trees which had been felled by the woodman.

This second inundation of lava did not, however, last long. The villages and towns situated at the base of the mountain were no longer directly menaced; but the disasters caused by the eruption were, notwithstanding, very considerable. A number of farm-houses were swept away; vast tracts of pasturage and cultivated ground were covered by slowly hardening rock, and—a

misfortune which was all the worse on account of the almost general deforesting of Sicily—a wide band of forest, comprising, according to the various estimates that were made, from 100,000 to 130,000 trees—oaks, pines, chestnuts, or birches—was completely destroyed.

When seen from the lower part of the mountain, all these burning trunks borne along upon the lava, as if upon a river of fire, singularly contributed to the beauty of the spectacle. As is always the case in the events of this world, the misfortune of some proved to be a source of gratification to others. During the earliest period of the eruption, while the villagers of Etna looked at it with stupor, and were bitterly lamenting over the destruction of their forests, hundreds of curious spectators, brought daily by the steamboats from Catania and Messina, came to enjoy at their ease the contemplation of all the splendid horrors of the conflagration.

PYRAMIDS AND TWISTED COLUMNS.

The aspect of the current of lava, as it appeared covered with its envelope of scoriæ, was scarcely less remarkable than the sight of the matter in motion. The black or reddish aspect of the cheire was all roughened with sharp-edged projections, which resembled steps, pyramids or twisted columns, on which it was a difficult matter to venture, except at the risk of tearing the feet and hands. Some months after the commencement of the eruption, the onward motion of the interior of the molten stone, which, by breaking the outer crust in every direction, had ultimately given it this rugged outline, was still visibly taking place. Here and there cracks in the rock allowed a view, as if through an air-hole, of the red and liquid lava swelling up as it flowed gently along like some viscous matter.

A metallic clinking sound was incessantly heard, proceeding from the fall of the scoriæ, which were breaking under the pressure of the liquid matter. Sometimes, on the hardening current of lava, a kind of blister gradually rose, which either opened gently, or bursting with a crash gave vent to the molten mass which formed it. Fumerolles, composed of various gases, according to the degree of heat of the lava which gave rise to them, jetted

out from all the issues. Even on the banks of the river of stone the soil was in many places all burning and pierced with crevices, through which escaped a hot air thoroughly charged with the smell of burnt roots.

On the slopes of Frumento, quite close to the upper part of the fissure, at a spot where the liquid mass had flowed like a torrent, M. Fouqué noticed a remarkable phenomenon; sheaths of solidified lava were surrounding the trunks of pines, and thus showing the height to which the current of molten stone had reached.

In like manner, the streams of obsidian which flow rapidly from the basin of Kilauea, in the isle of Hawaii, leave behind them on the branches of the trees numerous stalactites like the icicles which are formed by melting snow which has again frozen. Below the escarpments of the Frumento, the torrent, which was there retarded in its progress, had not contented itself with bathing for a moment the trunks of the forest trees, but had laid them low. Great trunks of trees, broken down by the lava, lay stretched in disorder on the uneven bed of the stream, and, although they were only separated from the molten matter by a crust a few inches thick, numbers of them were still clothed with their bark; several had even preserved their branches.

PINE TREES AND FIRS.

At the edge of the cheire, some pine trees, which had perhaps been preserved from the fire by the moisture being converted by the heat into a kind of coating of steam, were surrounded by a wall of heaped up lava, and their foliage still continued green; it could not yet be ascertained if the sources of the sap had perished in their roots.

In some places, rows of firs very close together were sufficient to change the direction of the flow, and to cause a lateral deviation. Not far from the crater of eruption, on the western bank of the great cheire, a trunk of a tree was noticed which by istelf had been able to keep back a branch of the stream, and to prevent it from filling up the glen which opened immediately below.

This tree, being thrown down by the weight of the scoriæ, had

fallen so as to bar up a slight depression in the ground which presented a natural bed to the molten matter. The latter had bent and cracked the trunk, but had failed in breaking it, and the stony torrent had remained suspended, so to speak, above the beautiful wooden slopes which it threatened to destroy completely.

Round the very mouth of the volcano, a vast glade was formed in the forest; the ground was covered everywhere with ashes which the wind had blown into hillocks, like the dunes on the sea coast; all the trees had been broken down by the volcanic projectiles, and burned by the scoriæ and small stones. The nearest trees that were met with, at unequal distances from the mouths of eruption, had had their branches torn off by the falling lumps of stone, or were buried in ashes up to their terminal crown.

SEVENTY-FIVE RECORDED ERUPTIONS.

A spectator might have walked among a number of yellow branches which were once the tops of lofty pines. Thus, on the plateau of Frumento and the lower slopes, everything was changed both in form and aspect; we might justly say that, by the effects of the erupted matter, the outline of the sides of Etna itself had been perceptibly modified.

And yet this last eruption, one of the most important in our epoch, is but an insignificant episode in the history of the mountain; it was but a mere pulsation of Etna. During the last twenty centuries only, more than seventy-five eruptions have taken place, and in some of them the flows of lava have been more than twelve miles in length, and have covered areas of more than forty square miles, which were once in a perfect state of cultivation, and dotted over with towns and villages. In former ages, thousands of other lava-flows and cones of ashes have gradually raised and lengthened the slopes of the mountain.

The mass of Mount Etna, the total bulk of which is three or four thousand times greater than the most considerable of the rivers of stone vomited from its bosom, is, in fact, from its summit to its base, down even to the lowest submarine depths, nothing but the product of successive eruptions throwing out the molten

matter of the interior. The volcano itself has slowly raised the walls of its crater, and then extended its long slopes down to the waters of the Ionian Sea. By its fresh beds of lava and scoriæ incessantly renewed one upon the other, it has ultimately reared its summit into the regions of snow, and has become, as Pindar called it, the great "pillar of heaven."

The earth being generally looked upon as immobility itself, it is a very strange thing to see it open to shoot out into the air torrents of gas, and shedding forth like a river the molten rocks of its interior. From what invisible source do all these fluid matters proceed which spread out in sheets over vast regions? Whence come those enormous bodies of steam, extensive enough to gather immediately in clouds around the loftiest summits, and sometimes indeed to fall in actual rain-showers? Science, as we have already said, has not completely answered these questions, the positive solution of which would be so highly important for our knowledge of the globe on which we live.

AN OLD POPULAR SUPERSTITION.

According to an ancient popular belief, Etna merely vomits forth, in the shape of vapor, the water which the sea has poured into the gulf of Charybdis. This legend, although clothed in a poetic garb, has in fact become the hypothesis which is thought beyond dispute by those savants who look upon volcanic eruptions as being a series of phenomena caused chiefly by water converted into steam.

The remarkable fact that all volcanoes are arranged in a kind of line along the coasts of the sea, or of inland lacustrine basins, is one of the great points which testify in favor of this opinion as to the infiltration of water, and give to it a high degree of probability. The Pacific, which is the principal reservoir of the water of our earth, is circled round by a series of volcanic mountains, some ranged in chains, and others very distant from one another, but still maintaining an evident mutual connection, constituting a "circle of fire," the total development of which is about 22,000 miles in length.

This ring of volcanoes does not exactly coincide with the semicircle formed by the coasts of Australia, the Sunda Islands, the Asiatic continent, and the western coasts of the New World. Like a crater described within some ancient and more extensive outlet of eruption, the great circle of igneous mountains extends

PICTURESQUE VIEW OF LAKE TAUPO AND VOLCANIC MOUNTAINS.

its immense curve in a westward direction across the waves of the Pacific, from New Zealand to the peninsula of Alaska; on the east, it is based on the coast of America, rising in the south so as to form some of the loftiest summits of the Andes.

The still smoking volcanoes of New Zealand, Tongariro and the cone of Whakari, on White Island, are, in the midst of the southern waters of the Pacific properly so called, the first evidence

of volcanic activity. On the north, a considerable space extends in which no volcanoes have yet been observed. The group of the Feejee Islands, at which the volcanic ring recommences, presents a large number of former craters which still manifest the internal action of the lava by the abundance of thermal springs. At this point, a branch crossing the South Sea in an oblique direction from the basaltic islands of Juan Fernandez as far as the active volcanoes of the Friendly group, unites itself with the principal chain which passes round, in a northeast direction, the coast of Australia and New Guinea.

GREAT FOCUS OF LAVA STREAMS.

The volcanoes of Abrim and Tanna, in the New Hebrides, Tinahoro, in the archipelago of Santa Cruz, and Semoya, in the Salomon Isles, succeeding one after the other, connect the knot of the Feejees to the region of the Sunda Islands, where the earth is so often agitated by violent shocks. This region may be considered as the great focus of the lava streams of our planet. On the kind of broken isthmus which connects Australia with the Indo-Chinese peninsula, and separates the Pacific Ocean from the great Indian seas, one hundred and nine volcanoes are vomiting out lava, ashes, or mud in full activity, destroying from time to time the towns and the villages which lie upon their slopes; sometimes, in their more terrible explosions, they ultimately explode bodily, covering with the dust of their fragments areas of several thousands of miles in extent.

From Papua to Sumatra, every large island, including probably the almost unknown tracts of Borneo, is pierced with one or more volcanic outlets. There are Timor, Flores, Sumbawa, Lombok, Bali, and Java, which last has no less than forty-five volcanoes, twenty-eight of which are in a state of activity, and, lastly, the beautiful island of Sumatra. Then, to the east of Borneo—Ceram, Amboyna, Gilolo, the volcano of Ternata, sung by Camoens, Celebes, Mindanao, Mindoro, and Luzon; these form across the sea, as it were, two great tracks of fire.

Northward of Luzon, the volcanic ring curves gradually so as

to follow a direction parallel to the coast of Asia. Formosa, the Liou-Kieou archipelago, and other groups of islands stand in a line over the submarine volcanic fissure; farther on, there are the numerous volcanoes of Japan, one of which, Fusiyama, with a cone of admirable regularity, is looked upon by the inhabitants of Niphon as a sacred mountain, from which the gods come down. The elongated archipelago of the Kuriles, comprising about a dozen volcanic orifices, unites Japan to the peninsula of Kamschatka, in which no less than fourteen volcanoes are reckoned as being in full activity.

To the east of this peninsula, the range of craters suddenly changes its direction, and describes a graceful semicircle across the Pacific, from Behring Island to the point of Alaska. Thirty-four smoking cones stand on this great transversal dike, extending from continent to continent. Ounimak, which rises on the extremity of the peninsula of Alaska, the peak of which is 7939 feet in height, serves as the western limit of the New World, and is also pierced by a crater in a state of full activity.

VOLCANO IN ALASKA.

Eastward of the peninsula, the volcanic chain extends along the seacost of the continent. Mount St. Elias, one of the highest summits in America, often vomits lava from its crater, which opens at an elevation of 17,716 feet. Farther to the south, another active volcano, Mount Fairweather, rises to a height of 14,370 feet. Next comes Mount Edgecumbe, in Lazarus Island, and the volcanic region of British Columbia. The whole chain of the Cascades, in Oregon, as well as the parallel ranges of the Sierra Nevada and the Rocky Mountains, are overlooked by a great number of volcanoes; but only a few of them continue to throw out smoke and ashes: these are Mount Baker, Renier, and St. Helens, enormous peaks 10,000 to 16,000 feet high.

In California and Northern Mexico, it is probable that the basaltic and trachtic mountains on the coast no longer present outlets of eruption. Subterranean activity is not manifested with any degree of violence until we reach the high plateaux of Central

Mexico. There a series of volcanoes, rising over a fissure crossing the continent, extends over the whole plateau of Anahuac, from the Southern Ocean to the Gulf of Mexico. The Colima, then the celebrated Jorullo, which made its appearance in 1759, the Nevado de Tolima, Istacihuetl, Popocatepetl, Orizaba, and Tuxtla are the vents for the furnace of lava which is boiling beneath the Mexican plateau.

To the south, in Gautemala and the South American republics, thirty burning mountains, much more active and terrible than those of Anahuac, rise in two chains, one of which is parallel to the sea-coast, and the other crosses obliquely the isthmus of Nicaragua. Among these numerous volcanoes there are some, the names of which have become famous on account of the frightful disasters which have been caused by their eruptions. Such are the mountains del Fuego and del Agua, above the Ciudad-Antigua of Gautemala; the Phare d'Isalco, which during the night lights up far and wide the plains of Salvador with its jets of molten stone and its column of red smoke; Coseguina, the last great eruption of which was probably the most formidable of modern times; the Viejo, Nuevo, Momotombo, and other mountains, which are almost worshiped from being so much dreaded.

ON THE PACIFIC COAST.

The depressions of the isthmuses of Panama and Darien interrupt the series of volcanoes which border on the coast of the Pacific. The peak of Tolima, which rises to the great height of 17,716 feet, is the most northern of the active volcanoes of South America, and is also one of the most distant from the sea among all the fire-vomiting mountains, for the distance from its base to the Pacific coast is not less than 124 miles. South of Tolima, and the great plateau of Pasto, where there likewise exists a crater, stands the magnificent group of sixteen volcanoes, some already extinct and some still smoking, over which towers the proud dome of Chimborazo.

Occupying an elliptical space, the great axis of which is only about 112 miles long, this group, comprising the Tunguagua,

Carahuizo, Cotopaxi, Antisana, Pichincha, Imbabura, and Sangay, is often looked upon as but one volcano with several eruptions; it is the cluster which, on the southern coasts of the Isthmus of Panama, corresponds symmetrically to the volcanic group of Anahuac. South of Sangay, which is perhaps the most destructive volcano on the earth, the chain of the Cordelleras offers no volcanoes for a length of about 930 miles; but in Southern Peru the volcanic series recommences, and outlets of eruption still in action open at intervals among extinct volcanoes and domes of trachyte.

The three smoking peaks of the inhabited part of Chili, the mountains of Antuco, Villarica, and Osono, terminate the series of the great American volcanoes; the activity of subterranean action is, however, disclosed by some other less elevated craters down to the extremity of the continent as far as the point of Terra-del-Fuego. This is not all; the South Shetland Islands, situated in the Southern Ocean, in a line with the New World, are likewise volcanic in their character; and if the same direction be followed toward the polar regions, the line will ultimately touch upon the coasts of the land of Victoria, on which rise the two lofty volcanoes of Erebus and Mount Terror, discovered by Sir John Ross.

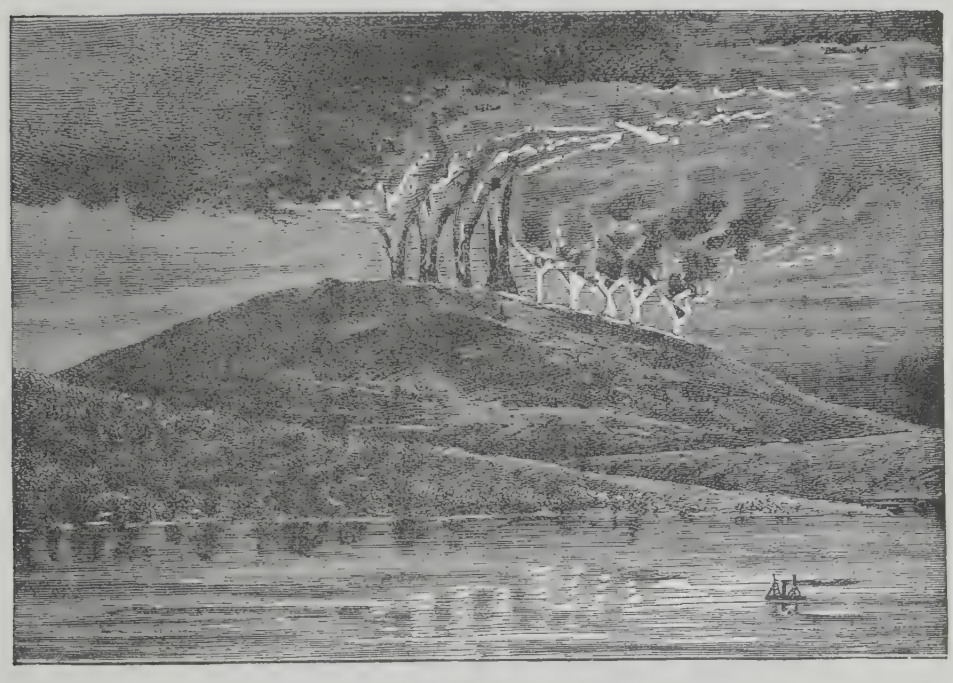
VOLCANIC CIRCLE ROUND THE EARTH.

Stretching round the sphere of the earth, the great volcanic circle is extended toward the north by various islets of the antartic, and ultimately rejoins the archipelago of New Zealand. Thus is completed the great ring of fire which circles round the whole surface of the Pacific Ocean.

Within this ampitheatre of volcanoes a multitude of those charming isles, which are scattered in pleiads over the ocean, are also of volcanic origin, and many of them can be distinguished from afar by their smoking or flaming craters. Of this kind are some of the Marianne and Gallapagos Islands, which contain several orifices in full activity, and more than two thousand cones in a state of repose. Among these we must especially mention the Sandwich Islands, the lofty volcanoes of which rise in the

middle central basin of the North Pacific like so many cones of eruption in the midst of a former crater changed into a lake.

The Mauna-Loa and Mauna-Kea, the two volcanic summits of the island of Hawaii, are each more than 13,000 feet in height; and the eruptions of the first cone, which are still in full activity, must be reckoned among the most magnificent spectacles of this kind. On the sides of the Mauna-Loa opens the boiling crater of



VOLCANO OF TONGARRIRO, NEW ZEALAND.

Kilauea, which is, without doubt, the most remarkable lava-source which exists on our planet.

Round the circumference of the Indian Ocean the border of volcanoes is much less distinct than round the Pacific; still it is possible to recognize some of its elements. To the north of Java and Sumatra, the volcanoes of which overlook the eastern portion of the basins of the Indian seas, stretches the volcanic archipelago of the Andaman and Nicobar Islands, in which there are several cones of eruption in full activity. On the west of Hindostan, the

peninsula of Kutch, and the delta of the Indus, are often agitated by subterranean forces.

Many mountains on the Arabian coast are nothing but masses of lava; and, if various travelers are to be believed, the volcanic furnace of these countries is not yet extinct. The Kenia, the great mountain of Eastern Africa, has on its own summit a crater still in action—perhaps the only one which exists on this continent. Lastly, a large number of islands which surround the Indian Ocean on the west and on the south—Socotora, Mauritius, Reunion, St. Paul, and Amsterdam Islands—are nothing but cones of eruption, which have gradually emerged from the bed of the ocean.

The volcanic districts which are scattered on the edge of the Atlantic are likewise distributed with a kind of symmetry round three sides of this great basin. On the north, Jan Mayen, so often wrapt in mist, and the more considerable island of Iceland, pierced by numerous craters, Hecla, the Skapta-Jokul, the Kotlugaja, and seventeen other mountains of eruption, separate the Atlantic from the Polar Ocean. At about 1500 miles nearer the equator the peaks of the Azores, some extinct and some still burning, rise out of the sea.

DEAD VOLCANOES.

The archipelago of the Canaries, over which towers the lofty mass of the peak of Teyda, continues toward the south the volcanic line of the Azores, and is itself prolonged by the smoking summits of the Cape de Verde Islands. All the other mountains of lava which spring up from the bed of the Atlantic more to the south appear to have completely lost their activity, and on the coast itself there is, according to Burton, only one volcano still in action—that of the Cameroons. With regard to the "line of fire" along the western Atlantic, it is developed at the entrance of the Caribbean Sea with perfect regularity, like the range of the Aleutian Isles. Trinidad, Grenada, St. Vincent, St. Lucia, Dominica, Gaudeloupe, Montserrat, Nevis, St. Kitts, and St. Eustatius are so many outlets of volcanic force, either through their

smoking craters or their mud volcanoes, their solfataras or their thermal springs.

North and south of the Antilles, the eastern coast of America does not present a single vent of eruption. It is a remarkable fact that the two volcanic groups of the Antilles and the Sunda Islands are situated exactly at the antipodes one of the other, and also in the vicinity of the two poles of flattening, the existence of which on the surface of the globe has been proved by the recent calculations of astronomers. More than this, these two great volcanic centres, which are undoubtedly the most active on the whole earth, flank, one on the west and the other on the east, the immense curve of volcanoes which spreads round the Pacific.

HIGH SUMMITS ON FIRE.

The Mediterranean is not surrounded by a circle of volcanoes; but there, as elsewhere, it is from the midst of the sea, or immediately on the sea-coast, that the burning mountains rise—Etna, Vesuvius, Stromboli, Volcano, Epomeo and Santorin. In like manner, the volcanoes of mud and gas of the peninsula of Apcheron, and the summit of Demavend, 14,436 feet high, rise at no great distance from the Caspian Sea.

With regard to the volcanoes of Mongolia—the Turfan, which is said to be still in action, and the Pe-chan, which, according to Chinese authors, vomited forth, up to the seventh century, "fire, smoke, and molten stone, which hardened as it cooled"—their existence is not yet absolutely proved; but even if these mountains, situated in the centre of the continent, should be in full activity, their phenomena might depend on the vicinity of extensive sheets of water, for this very region of Asia still possesses a large number of lakes, the remnants of a former inland sea, almost as vast as the Mediterranean.

What is the number of volcanoes which are still vomiting forth lava during the present period of the earth's vitality? It is difficult to ascertain, for often mountains have seemed for a long time to be extinct; forests have grown up in their disused craters, and their beds of lava have been covered up under a rich carpet of

vegetation, when suddenly the sleeping force beneath is aroused and some fresh volcanic outlet is opened through the ground.

When Vesuvius woke up from its protracted slumber to swallow up Pompeii and the other towns lying round its base, it had rested for some centuries, and the Romans looked upon it as nothing but a lifeless mountain like the peaks of the Apennines. On the other hand, it is very possible that some craters, from which steam and jets of gas are still escaping, or which have thrown out lava during the historic era, have entered decisively into a period of repose, ceasing somehow to maintain their communication with the subterranean centre of molten matter. The number of vents which serve for the eruption of lava can, therefore, be ascertained in a merely approximate way.

Humboldt enumerates 223 active volcanoes; Keith Johnston arrives at the larger number of 270, 190 of which are comprehended in the islands and the Pacific "circle of fire;" but this latter estimate is probably too small. To the number of these burning mountains, standing nearly all of them on the sea-shore, or in the vicinity of some great fresh water basin, must be added the salses, or mud-volcanoes, which are also found near large sheets of salt water. With regard to the thousands of extinct volcanoes which rise in various parts of the interior of the continent, geology shows that the sea used formerly to extend round their bases.

CHAPTER XXI.

TORRENTS OF STEAM ESCAPING FROM CRATERS.—GASES PRODUCED BY THE DECOMPOSITION OF SEA-WATER.—HYPOTHESES AS TO THE ORIGIN OF ERUPTION.—GROWTH OF VOLCANOES.

ONE of the most decisive arguments which can be used in favor of a free communication existing between marine basins and volcanic centres is drawn from the large quantities of steam which escape from craters during an eruption, and compose, according to M. Ch. Sainte-Claire Deville, at least 999 thousandths of the supposed volcanic smoke. During the eruption of Etna, in 1865, M. Fouqué attempted to gauge approximately the volume of water which made its escape in a gaseous form from the craters of eruption.

By taking as his scale of comparison the cone which appeared to him to emit an average quantity of steam, he found this mass, reduced to a liquid state, would be equivalent to about 79 cubic yards of water for each general explosion. Now, as these explosions took place on the average every four minutes during a hundred days, he arrived at the result, that the discharge of water during the continuance of the phenomenon might be estimated at 2,829,600 cubic yards of water—a flow equal to that of a permanent stream discharging fifty-five gallons a second. Added to this, account ought to have been taken of the enormous convolutions of vapor which were constantly issuing from the great terminal crater at Etna, and, bending over under the pressure of the wind, spread out in an immense arch around the vault of the sky.

In great volcanic eruptions it often happens that these clouds of steam, becoming suddenly condensed in the higher layers of the atmosphere, fall in heavy showers of rain, and form temporary torrents on the mountain-side. According to the statements of Sir James Ross, the mountain Erebus, of the antarctic land, is

covered with snow, which it has just vomited forth in the form of vapor. It has besides been remarked that the vapor which issues from volcanoes is not always warm; often, according to Pœppig, it is of the same temperature as the surrounding air.

As was said long since by Krug von Nidda, a German savant, volcanoes must be looked upon as enormous intermittent springs. The basaltic flows may be compared to streams on account of the water which they contain. It is probable that most of the lava which flows from volcanic fissures owes its mobility to the innumerable particles of vapor which fill up all the interstices of moving mass. Being composed in great measure of crystals already formed in the body of which may be noticed nodules and crystals rounded by friction, the lava would be unable to descend over the slopes if it were not rendered fluid by its mixture with steam; and the gradual slacking in speed and ultimate stoppage of the flow are chiefly caused by the setting free of the gases which served as a vehicle to the solid matter. Owing to this rapid loss of their humidity, basalts contain in their pores but a very slight quantity of water in comparison with other rocks. Yet even old lava themselves contain as much as ten to nineteen thousandths of water at the edge of the bed, and five to eighteen thousandths at the centre.

SEA-WATER DECOMPOSED.

The various substances which are produced from craters also tend to show that sea-water has been decomposed in the great labaratory of lava. Ordinary salt or chloride of sodium, which is the mineral that is most abundant in sea-water, is also that which is deposited the first and most plentifully round the orifices of eruption. Sometimes, the scoriæ and ashes are covered for a vast space with a white efflorescence, which is nothing but common salt; one might fancy it a shingly beach which had just been left by the ebbing tide. After each eruption of Hecla, the Icelanders are in the habit, it is said, of collecting salt on the slopes. The lava from the eruption of Frumento, analyzed by M. Fouqué, contained about thirteen ten thousandths of marine salt.

Almost all other component parts of sea-water are likewise found in the gases and deposits of fumerolles; only the salts of magnesia have disappeared, but still are found under another form among the volcanic products. Being decomposed by the high temperature, just as they would be in the laboratory of a chemist, they go to constitute other bodies. Thus the chloride of magnesium is changed into hydrochloric acid and magnesia; the gas escapes in abundance from the fumerolles, while the magnesia remains fixed in the lava.

FOUR PERIODS IN EVERY ERUPTION.

As M. Ch. Sainte-Claire Deville was the first to ascertain with certainty, four successive periods may be observed in every eruption, each of which periods assumes a different character, owing to the exhalation of certain substances. After the first period, remarkable especially for marine salt and the various compounds of soda and potash, comes a second in which the temperature is lower, and during which brilliantly colored deposits of chloride of iron are formed and hydrochloric and sulphurous acids are expelled. When the temperature is below 392° (Fahr.), there are ammoniacal salts and needles of sulphur, which are found in yellowish masses on the scoriæ of lava.

Lastly, when the heat of the erupted bodies is below 212° (Fahr.), the fumerolles eject nothing but steam, azote, carbonic acid and combustible gases. Thus the activity of the exhalations and deposits is in proportion to the incandescence of the lava. At the commencement of the eruption, the orifices throw out a large quantity of substances, from marine salt to carbonic acid; but by degrees the power of elaboration weakens simultaneously with the heat, and the gases ejected gradually diminish in number, and testify, by their increasing rarity, to the approaching cessation of volcanic phenomena. In consequence of the difference which is presented by the exhalations during the various phases of eruptions of lava, observers have, at first sight, thought that each volcano was distinguished by emanations peculiar to itself. Hydrochloric acid was looked upon as one of the normal

products of Vesuvius, and sulphurous vapors as more especial to Etna. It was stated (with Boussingault) that carbonic acid was exhaled especially by the volcanoes of the Andes; and, with Bunsen, it was believed that combustible gases prevailed in the eruptions of Hecla.

In his beautiful investigations into the various chemical phenomena presented by Etna and the neighboring volcanic outlets, such as Vesuvius and Stromboli, M. Fouqué appears to have established as a fact which must be henceforth beyond dispute, that the gradual series of these emanations is just that which would be produced by the decomposition of sea-water. Added to this, we also find in lava iodine and fluorine, both of which we should expect to detect in it on account of their presence in sea-water. The salts of bromine, of which, however, only a slight trace is found in sea-water, have not yet been detected in volcanic products, which, no doubt, proceeds from the difficulty which chemists have experienced in separating such very small quantities.

MELTED ROCKS.

The other mattters ejected by eruptions are of terrestrial origin, and evidently proceed from rocks reduced by heat to a liquid or pasty state; they consist principally of silica and alumina, and contain, besides, lime, magnesia, potash, and soda. Oxides of iron also enter into the composition of lava, to the extent of more than one-tenth, which is a very considerable proportion, and warrants us in looking upon the volcanic flows as actual torrents of iron ore; sometimes, indeed, this metal appears in a pure state. It is to this presence of iron that lava especially owes its reddish color, and the sides of the crater their diversely colored sides.

Compounds of copper, maganese, cobalt, and lead are also met with in lava; but, in comparison with the iron, they are but of slight importance. Lastly, phosphates, ammonia, and gases composed of hydrogen and carbon are discharged during eruptions. The presence of these bodies is explained by the enormous proportion of animal and vegetable matter which is decomposed in

sea-water. Ehrenberg found the remains of marine animalculæ in the substances thrown out by volcanoes.

Is the composition of the lava, and especially that of the vapor and gases, the same in those eruptions which take place at a great distance from the ocean? It is probable that, as regards this point, considerable differences might be established between the products of volcanoes placed on the sea-coast, such as Vesuvius and Etna, and those which rise far in the interior of the land, as Tolima, Jorullo, and Puracé. This comparative study, however, which would be calculated to throw light on the chemical phenomena of deep-lying beds, has as yet been made at only a few points.

HOT WATER UNDER GROUND.

Eruptions are rare in volcanoes situated far from the coast, and when they do take place, scientific men do not happen to be on the spot to study the course of the occurrence. Popocatepetl, one of the most remarkable continental volcanoes, produces a large quantity of hydrochloric acid; the snow from it, which has a very decided muriatic taste, is carried by the rain into the Lake of Tezcuco, where, in conjunction with soda, its forms salt.

When the water, either of sea or rivers, penetrates into the crevices of the terrestrial envelope, it gradually increases in temperature the same as the rocks it passes through. It is well known that this increase of heat may be estimated on the average at least as regards the external part of the planet, at 1° (Fahr.) for every 54 feet in depth. Following this law, water descending to a point 7500 feet below the surface would show, in the southern latitudes of Europe, a temperature of about 212° (Fahr.). But it would not on this account be converted into steam, but would remain in a liquid state, owing to the enormous pressure which it has to undergo from the upper layers.

According to calculations, which are based, it is true, on various hypothetical data, it would be at a point more than nine miles below the surface of the ground that the expansive force of the water would attain sufficient energy to balance the weight of the superincumbent liquid masses, and to be suddenly converted

into steam at a temperature of 800° to 900° (Fahr.). These gaseous masses would then have force to lift a column of water of the weight of 1500 atmospheres; if, however, from any cause, they can not escape as quickly as they are formed, they exercise their pressure in every direction, and ultimately find their way from fissure to fissure until they reach the fused rocks which exist in the depths. To this incessantly increasing pressure we must, therefore, attribute the ascent of the lava into vent-holes of volcanoes, the occurrence of earthquakes, the fusion and the rupture of the terrestrial crust, and, finally, the violent eruptions of the imprisoned fluids.

But why should the vapor thus pervade the subterranean strata and upheave them into volcanic cones, when, by the natural effect of its overcoming the columns of water which press it down, it ought simply to rise toward the bed of the sea from which it descended? In the present state of science, this is a question to which it seems absolutely impossible to give a satisfactory answer, and geologists must at least have the merit of candidly acknowledging their ignorance on this point.

STEAM IN VOLCANIC ERUPTIONS.

The discoveries of natural philosophy and chemistry, which have been the means of making known to us the enormous activity of steam in volcanic eruptions, will doubtless, sooner or later, explain to us in what way this activity is exercised in the subterranean cavities. But at the present time the phenomena which are taking place in the interior of our globe are not better known to us than the history of the lunar volcanoes.

Be this as it may, the direct observations which have been made on volcanic eruptions have now rendered it a very doubtful point whether the lavas of various volcanoes proceed from one and the same reservoir of molten matter, or from the supposed great central furnace which is said to fill the whole of the interior of the planet. Volcanoes which are very close to one another show no coincidence in the times of their eruptions, and vomit forth at different epochs, lavas which are most dissimilar both in

appearance and mineralogical composition. These facts would be eminently impossible, if the craters were fed from the same source.

Etna, the group of the Lipari Isles, and Vesuvius, have often been quoted as being volcanic outlets placed upon the same fracture of the terrestrial crust; and it is added, in corroboration of this assertion, that a line traced from the Sicilian volcano to that of Naples passes through the ever-active furnace of the Lipari Isles. Although the mountain of Stromboli, so regular in its eruptions, is situated on a line slightly divergent from the principal line, and, on the other side, the volcanic isles of Salini, Alicudi, and Felicudi tend from east to west, it is possible, and even probable, that Vesuvius and Etna are in fact situated on fissures of the earth which were once in mutual communication. But during the thousands of years in which these great craters have been at work, no connection between their eruptions has ever been positively certified.

TWO INDEPENDENT VOLCANOES.

Sometimes, as in 1865, Vesuvius vomits forth lava at the same time as Etna; sometimes it is in a state of repose when its mighty neighbor is in full eruption, and rouses up when the lava of Etna has cooled. There is nothing which affords the slighest indication of any law of rhythm or periodicity in the eruptive phenomena of the two volcanoes. The inhabitants of Stromboli state that, during the winter of 1865, at the moment when the sides of Etna were rent, the volcanic impulse manifested itself very strongly in their island by stirring up the always agitated waves of the lava-crater which commands their vineyards and houses.

A comparative calm, however, soon succeeded this temporary effervescence, and in the adjacent island of Volcano no increase of activity was noticed. If the shafts of Etna, Vesuvius, and the interveniug volcanoes, take their rise in one and the same ocean of liquid lava, all the lower craters must necessarily overflow simultaneously with the most elevated. Now, as has often been

noticed, the lava may ascend to the summit of Etna, at a height of 10,827 feet, without a simultaneous flow of rivers of molten stone from Vesuvius, Stromboli, and Volcano, which are respectively but one-third, one-fourth, and one-tenth the height of the former. In like manner, Kilauea, situated on the sides of Mauna-Loa, in the Isle of Hawaii, in no way participates in the eruptions of the central crater opening at a point 9800 feet higher up, and not more than twelves miles away.

If there is any present geological connection between the volcanoes of one and the same region, it probably must be attributed to the fact of their phenomenal depending on the same climatic causes, and not because their bases penetrate to one and the same ocean of fire. Volcanic orifices are not, therefore, "safety valves," for two centers of activity may exist on one mountain without their eruptions exhibiting the least appearance of connection.

OPINIONS OF MEN OF SCIENCE.

Isolated as they are amid all the other formations on the surface of the earth, lavas appear as if almost independent of the rest. Basalts, trachytes, and volcanic ashes, are the comparatively modern products which are scarcely met with in the periods anterior to the Tertiary age. Only a very small quantity of these lavas of eruption has been found in the Secondary and Palæozoic rocks. Formerly, most geologists thought that the granites and rocks similar to them had issued from the earth in a pasty or liquid state; they looked upon them as the "lavas of the past," and believed that these first eruptive rocks were succeeded age after age by the diorites, the porphyries, the trap-rocks, then by the trachytes and the basalts of our own day, all drawn from a constantly increasing depth.

They thought also that, in the future, when the whole series of the present lavas shall have been thrown up to the surface, volcanoes would produce other substances as distinct from the lavas as the latter are from the granite. Granites, however, differ so much from the trachytes and basalts as to render it impossible for us to imagine that they have the same origin; added to which,

the labors of modern savants have proved that, under the action of fire, granite and the other rocky masses of the same kind, would have been unable to assume the crystalline texture which distinguishes them. We are, then, still ignorant how volcanic eruptions commenced upon the earth, and how they are connected with the other great phenomena which have co-operated in the formation of the external strata of the globe.

Considered singly, each volcano is nothing but a mere orifice, temporary or permanent, through which a furnace of lava is brought into communication with the surface of the globe. The matter thrown out accumulates outside the opening, and gradually forms a cone of debris more or less regular in its shape, which ultimately attains to considerable dimensions. One flow of molten matter follows another, and thus is gradually formed the skeleton of the mountain; the ashes and stones thrown out by the crater accumulate in long slopes; the volcano simultaneously grows wider and higher.

MOUNTS INTO CLOUDS AND SNOW.

After a long succession of eruptions, it at last mounts up into the clouds, and then into the region of permanent snow. At the first outbreak of the volcano the orifice is on the surface of the ground; it is then prolonged like an immense chimney through the center of the cone, and each new river of lava which flows from the summit increases the height of this conduit. Thus the highest outlet of Etna opens at an elevation of 10,892 feet above the level of the sea; Teneriffe rises to 12,139 feet; Mauna-Loa, in Hawaii, to 13,943 feet, and, more gigantic still, Sangay and Sahama, in the Cordilleras, attain to 18,372 and 23,950 feet in elevation.

This theory of the formation of volcanic mountains by the accumulation of lava and other matters cast out of the bosom of the earth presents itself quite naturally to one's mind. Most savants, from Saussure and Spallanzani down to Virlet, Constant Prévost, Poulett Scrope and Lyell, have been led, by their investigations, to adopt it entirely; indeed, in the present day it is

scarcely disputed. It is true that Humboldt, Leopold von Buch, and, following them, M. Elie de Beaumont, have put forth quite a different hypothesis, as to the origin of several volcanoes, such as Etna, Vesuvius and the Peak of Teneriffe.

According to their theory, volcanic mountains do not owe their present conformation to the long-continued accumulation of lava and ashes, but rather to the sudden upheaval of the terrestrial strata. During some revolution of the globe, the pent-up matter in the interior suddenly upheaves a portion of the crust of the planet into the form of a cone, and opens a funnel-shaped gulf between the dislocated strata, thus by one single paroxysm producing lofty mountains, as we now see them. As an important instance of a crater thus formed by the upheaval and rupture of the terrestrial strata, Leopold von Buch mentions the enormous abyss of the Isle of Palma, known by the natives under the name of "Caldron," or Caldera.

HUGE FUNNEL-SHAPED CAVITY.

The funnel-shaped cavity is of enormous dimensions, and is not less than four or five miles in width on the average; the bottom of it is situated about 2000 feet above the level of the sea. Lofty slopes, from 1000 to 2000 feet in height, rise round the vast amphitheatre, and abut upon inaccessible cliffs, the upper ledges of which reach a total altitude of 5900 to 6900 feet in height. The highest point, the Pico-de-los-Muchachos, is covered by snow during the winter months; and, although it penetrates to regions of the atmosphere which are of a very different character from those of the rest of the island, the slope that is turned toward the crater is so steep that blocks of stone falling from the summit roll down into the enclosed hollow.

The prodigious cavity in the Isle of Palma was, perhaps, the most striking instance that Leopold von Buch could bring forward in favor of his hypothesis; nevertheless, the exploration of this island, since carried out by Hartung, Lyell and other travelers, is very far from confirming the ideas of the illustrious German geologist. The lofty side walls of the hollow appear to be formed

principally, not of solid lava, which constitute scarcely a quarter of the whole mass, but of layers of ashes and scoriæ, regularly arranged like beds of sand on the incline of a talus. Basalts and strata of ashes lie upon one another in the greatest order round the inclosed hollow, which would be a fact impossible to comprehend if any sudden upheaval, acting in an upward direction with sufficient violence to break the terrestrial crust, had shattered and ruptured all the strata, and by a mighty explosion, opened out the immense Caldron of Palma.

LIKE CRACKS IN BROKEN GLASS.

Finally, if a phenomenon of this kind had taken place, star-formed cracks, like those produced in broken glass, would be visible across the thickness of the upheaved strata, and their greatest width would be turned toward the crater. Now there are no fissures of this kind, and the ravines in the circumference of the volcano, which one might perhaps be tempted to confound with actual ruptures of the ground, become wider in proportion as they approach the sea. The enormous cavity in Palma is, therefore, a crater similar to those of volcanoes of less dimensions. It is, however, certain that the Caldera was once both shallower and less in extent, for the ashes and volcanic scoriæ are easily carried away by the rain, which is swallowed up in the bottom of the basin, and has hollowed out for itself a wide drainage channel in a southwest direction.

M. Elie de Beaumont, as his chief support of Leopold von Buch's hypothesis, brought forward the fact that most of the strata of lava—a section of which may be seen on the sides of Etna, in the immense amphitheatre of the Val del Bove—are very sharply inclined. The celebrated geologist affirmed that thick sheets of molten matter could not run down steep slopes without being very soon reduced, in consequence of the acceleration of their speed, into thin layers of irregular scoriæ. If this were really the case, the position of the thick flows of lava in the Val del Bove must have changed since the date of the eruption. It would then be necessary to admit that they have been violently tilted up after having

been originally deposited on the soil in sheets, which were either horizontal or very gently sloped.

Nevertheless, the recent observations made by Sir C. Lyell, those of Darwin on the cones of the Gallapagos Isles, and of Dana on the lava flows of Kilauea; lastly, the remarks of the Italian savants who studied on the spot the volcanic phenomena of Vesuvius and Etna, have satisfactorily proved that, in modern times, a great number of rivers of lava, and especially that of the Val-de-Bove, in 1852 and 1853, have flowed over steep slopes varying in inclination from 15 to 40 degrees. It must, besides, be understood that the lava which poured over the steepest slopes was exactly that portion which, not having experienced any cause of delay, or met with any obstacle, in its course, presented layers of the most uniform consistence and the most regular action.

CLEFT IN THE EARTH.

One of the strongest arguments of scientific men in favor of the theory of upheaval is, that certain volcanic mountains, especially that of Monte-Nuovo, Pouzzoles, and Jorullo, in Mexico, had been suddenly raised up by the swellings of the soil. Now the unanimous testimony of those who, more than three centuries ago, witnessed the eruption of Monte-Nuovo, is, that the earth was cleft open, affording an outlet to vapor, ashes, scoriæ, and lava, and that the hill, very much lower than some of the subordinate cones of Etna, gradually rose during four days by the heaping up of the matter thrown out. The total volume of this eruption was no doubt considerable, but compared with the amount of matter which flowed down upon Catania in 1669, or with the rivers of lava from Skaptar-Jokul, it is a mass of no great importance.

Added to this, if the soil was really upheaved, how was it that the neighboring houses were not thrown down, and that the colonnade of the Temple of Neptune, which stands at the foot of the mountain, kept its upright position? With regard to Jorullo, which rises to a height of more than 1650 feet, the only witnesses of this volcano making its first appearance were the Indians, who fled away to the neighboring heights, distracted with terror.

We have, therefore, no authentic testimony on which we can base an hypothesis as to any swelling up of the ground in the form of a blister. Quite the contrary, the travelers who have visited this Mexican volcano since Humboldt have discovered beds of lava lying one over the other, as in all other cones of eruption; and more than this, they have also ascertained that none of the strata in the ground overlooked by the mountain have been at all tilted up.

It is true enough that local swellings have often been observed in the burning matter issuing from the interior of the earth; in many places the lava is pierced by deep caverns, and entire mountains—especially that of Volcano—have so many hollows in the rocks on their sides that every step of the climber resounds on them as if in a vault. Besides, the lava itself, being a kind of impure glass, is so pervaded by bubbles filled with volatile matter that, when acted upon by fire, so as to expel the water and the gas, it loses on an average, according to Fouqué, two thirds of its weight.

MIXTURE OF LAVA AND VAPOR.

But these caverns, these hollows and bubbles, proceed from the mixture of the lava with vapor which is liberated with difficulty from the viscous mass, or are caused by the longitudinal rupture of the strata during an eruption, and can in no way be compared to the immense blister-like elevation which would be formed by the strata of a whole district being tilted up to a height of hundreds, or even thousands, of yards, leaving at the summit, between two lines of fracture, room for an immense cavity.

None of these prodigious upheavels have been directly observed by geologists, and none of the legends invented by the fears of our ancestors, referring to the sudden appearance of volcanic mountains, which have been since confirmed. Lastly, the very structure of the peaks which are said to have risen abruptly from the midst of the plains testifies to the gradual accumulation of material that has issued from the bowels of the earth. It is, therefore, prudent to dismiss definitely an hypothesis which marks

an important period in the history of geology, but which, for the future, can only serve to retard the progress of science.

As, when the burning matter seeks an outlet, the earth is generally cleft open in a straight line, the volcanic orifices are frequently distributed somewhat regularly along a fissure, and the heaps of erupted matter follow one another like the peaks in a mountain chain. In other places, however, the volcanic cones rise without any apparent order on ground that is variously cleft, just as if a wide surface had been softened in every direction, and had thus allowed the molten matter to make its escape, sometimes at one point, sometimes at another. From the town of Naples—which is itself built on a half crater in great part obliterated—to the Isle of Nisida, which is an old volcano of regular form, the Phlegræan Fields presents a remarkable example of this confusion of craters.

LANDSCAPE TURNED TO CHAOS.

Some are perfectly rounded, others are broken into, and their circle is invaded by the waters of the sea; grouped, for the most part, in irregular clumps, even encroaching upon one another and blending their walls, they give to the whole landscape a chaotic appearance. As Mr. Poulett Scrope very justly remarks, the aspect of the terrestrial surface at this spot reminds one exactly of the volcanic districts of the moon, dotted over, as it is, with craters.

As the type of a region pierced all over with volcanic orifices, we may also mention the Ishthmus of Auckland, in New Zealand, which Dr. Hockstetter has reckoned, in an area of 230 square miles, sixty-one independent volcanoes, 520 to 650 feet in height on the average. Some are mere cones of tufa; others are heaps of scoriæ, or even eruptive hillocks, which have shed out round them long flows of lava. At one time the Maori chiefs used to intrench themselves in these craters as if in citadels; they escarped the outer slopes in terraces, and furnished them with palisades. At the present day, the English colonists, having become lords of the soil, have constructed their farms and country

houses on these ancient volcanoes, and are constantly bringing the soil under cultivation.

The Safa, in the Djebel-Hauran, is also a complete chaos of hillocks and abysses. On this plateau of 460 square miles, which the Arabs call a "portion of hell," almost all the craters open on the surface of the ground, and not on the summits of volcanoes scattered here and there on the black surface. In every direction there may be seen rounded cavities like the vacuities formed in scoriæ by bubbles of gas, only these cavities are 600 to 900 feet wide, and 65 to 160 deep. Some are isolated; some either touch or are separated by nothing but narrow walls like masses of red or darkish-colored glass. One hardly cares to venture on these narrow isthmuse2, bordered by precipices, and intersected here and there by fissures.

ALWAYS SLOPING IN FORM.

The normal form of the volcanoes in which the work of eruption takes place is that of a slope of debris arranged in a circular form round the outlet. Whether the volcano be a mere cone of ashes or mud only a few yards high, or rise into the regions of the clouds, vomiting streams of lava over an extent of ten or twenty miles, it none the less adheres to the regular form so long as the eruptive action is maintained in the same channel, and the debris thrown out falls equally on the external slopes.

The beauty of the cone is increased by that of the crater. The terminal orifice from which the lava boils out well deserves, from the purity of its outline, its Greek name of "cup," and the harmony of its curve contrasts most gracefully with the declivity of the slope. In some volcanoes the symmetry of the architectural lines is so complete that the crater itself contains a cone placed exactly in the centre of the cavity, and pierced by a second crater in miniature, from which the vapor makes its escape.

Volcanoes in which the eruptive action frequently changes its position—and these are the more numerous class—do not possess this elegance of outline. Very often the upheaved lava finds some weak place in the walls of the crater; it hollows them out at first,

and then, bringing all its weight to bear on the rocks which oppose its passage, it ultimately completely breaks down the edge of the crater, leaving perhaps only one side standing. Among the European volcanoes, Vesuvius is the best example of these ruptured craters: before A. D. 79, the escarpments of La Somma, which now surround with their semicircular rampart the terminal cone of Vesuvius, were the real crater. The portion of it which no longer exists disappeared, and buried under its debris the towns of Herculaneum and Pompeii.

INCREASING DIMENSIONS.

Active volcanoes, however, never cease to increase in all their dimensions, and sooner or later the breach is ultimately repaired; the remains of the former craters are gradually hidden under the growing slopes of the central cone. Thus a former crater on Etna, which was situated at a point three miles in a straight line from the present outlet, at the commencement of the Val del Bove, has been gradually obliterated by the lava of successive eruptions; prolonged explorations on the part of MM. Seyell and Waltershausen have been necessary in order to find it out. The normal form of Etna is that of a cone of debris placed upon a large dome with long slopes, becoming more and more gentle, and descending gracefully toward the sea.

In fact, in most of the eruptions, the lava does not rise as far as the great crater, and breaks through the sides of the volcano so as to flow laterally over the flanks of Etna. These eruptions, succeeding one another in the course of centuries, bring about the necessary result of gradually enlarging the dome which constitutes the mass of the mountain, thus breaking the uniformity of the lateral talus. The same thing occurs with regard to Vesuvius on the side which faces the seacoast. There, the terminal cone stands on a kind of dome, which has been gradually formed by the coats of lava running one over the other. If Vesuvius continues to be the great volcanic outlet of Italy, and rises gradually into the sky by the superposition of lava and ashes, it cannot fail, some time or other, to assume a form similar to that of the Sicilian giant.

The volcanoes which present cones of almost perfect regularity are those which have their terminal outlet alone in a state of activity, and vomit out a large quantity of ashes or other matter which glides readily over the slopes. Among this class of mountains, those which attain any considerable elevation are distinguished by their majesty from all other peaks. Stromboli, although it is not more than 2600 feet in height, is one of the wonders of the Mediterranean. From its proud form, it will readily be understood that its roots plunge down into the sea to an enormous depth ; the slope of debris may be seen, so to speak, prolonged under the water down to the abysses of 3000 to 4000 feet, which the sounding-line has reached at the bottom of the Æolian Sea.

At sight of it one feels as if suspended in the midst of the void, as if the ship was sailing in the air midway up the mountain. This feeling of admiration mingled with dread increases when this great pharos of the Mediterranean is approached during the night over the dark-waved sea. Then the sky above the summit seems all lighted up by the reflection of the lava, and a misty band of vapor may be dimly seen girdling round the body of the volcano. In the daytime the impression made is of a different character ; but it is none the less deep, for the real grandeur of Stromboli consists not so much in the immensity of the mass as in the harmony of its proportions.

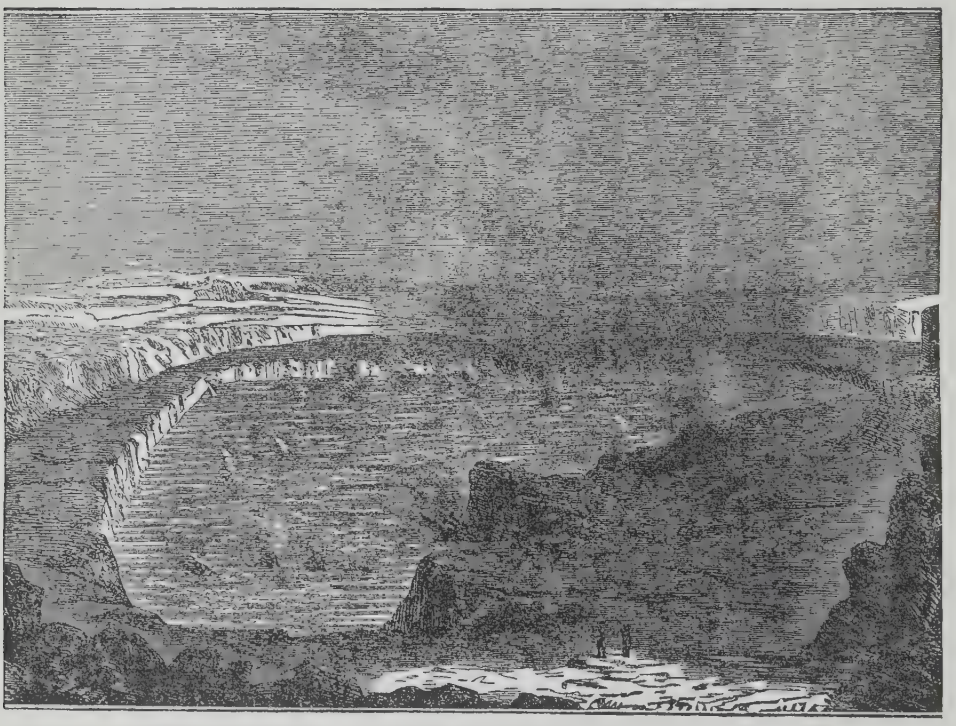
SACRED MOUNTAINS.

Volcanic mountains of an ideal form are those which infant nations have most adored. Among these sacred mountains are the sublime Cotopaxi of the Andes, Orizaba of Mexico, Mauna-Loa of Hawaii, and Fusi-Yama of Japan. The volcanoes of Java, and chiefly those in the eastern portion of the island, also present a very majestic appearance on account of their isolation.

Those on the western side are based upon an undulating plateau, which causes them to lose their appearance of height; but on the east all the volcanic mountains rise up from verdant plains like islands above the waves of the sea, and command the

horizon far and wide with their enormous cones. Between the Merapi and Lavoe mountains lies a depression, the highest ledge of which exceeds the level of the sea by only 312 feet. Between Lavoe and Villis the plain is 230 feet in height. Lastly, the plains which separate the Villis and Kelœet mountains nowhere attain an elevation of more than 200 feet above the ocean.

In the external details of their conformation many of the vol-



A REMARKABLE VOLCANO CRATER, ISLE OF JAVA.

canoes of Java present a regularity of outline which is all the more striking, since they owe it in great part to the monsoon rains, the most destructive agents of the tropical regions. In beating against the mountains, the clouds let fall their burden of moisture on the slopes composed of ashes and loose scoriæ. The latter offer but a slight resistance to the action of the temporary torrents which carry them away, and, crumbling down into the

plains which surround the base of the volcano, are deposited in long slopes, like those caused by avalanches.

In consequence of the fall of all this debris, the sides of the mountain are cut out at intervals by ravines or furrows, which gradually widen from the summit to the base of the mountains, and attain a depth of 200, 600, and 660 feet. There are some volcanoes, such as the Sumbing, in which these ravines assume so perfect a regularity that the whole mountain, with its equidistant furrows and its intermediate walls, resembles a gigantic edifice based upon enormous buttresses, like the nave of a Gothic cathedral.

BEAUTIFUL ISLAND.

Formerly the beauty of the island and the fury of its volcanoes were the cause of its being altogether dedicated to Siva, the god of destruction; and in the very craters of the burning mountains the worshipers of Terror and Death were in the habit of building their temples. In many spots the ruins of these sanctuaries are discovered in the midst of trees and thickets, which the Arab conquerors have left to grow in the formidable cavities of the volcanoes. Semerœ, the loftiest peak in the island, was the sacred mountain par excellence; the Sumbing, which rises in the centre of the island, was the "nail which fastens Java to the earth."

Even in our own time some faithful followers of Siva inhabit a sandy plain, more than four miles wide, which was once the crater of the Tengger volcano; every year they proceed solemnly to pour rice on the summit of an eruptive cone, into the roaring mouth of the monster. In like manner, in New Zealand, the ever-smoking orifice of Tongariro was considered as the only place worthy of receiving the dead bodies of their great chiefs: when cast into the crater, the heroes went to sleep among the gods.

But the volcanic divinities, like most of the other rulers invoked by nations, did not content themselves with the fruits of the earth or the companionship of a few warriors; they also demanded blood, both by their subterranean roarings, by their thundering eruptions, and their devastating rivers of lava. In-

numerable sacrifices have been offered to volcanoes to appease their anger: impelled by a mingled feeling of fear and ferocity, the priests of not a few religions have cast victims with great pomp into the gaping hollows of these immense furnaces.

Scarcely three centuries ago, when the disciples of Christianity were exterminated over the whole length and breadth of Japan, the followers of the new religion were thrown by hundreds into one of the craters of the Unsen, one of the most beautiful volcanoes of the archipelago; but this offering to the offended gods did not appease their anger, for, toward the end of the eighteenth century, this very same mountain and the neighboring summits caused by their eruptions one of the most frightful disasters of any that are mentioned in the history of volcanoes.

Actuated by a feeling of dread very similar to that exhibited by the Japanese priests, the Christian missionaries in America recognized in the burning mountains of the New World not the work of a god, but that of the devil, and went in procession to the edge of the craters to exorcise them. A legend tells how the monks of Nicaragua climbed the terrible volcano of Momotombo in order to quiet it by their conjurations; but they never returned; the monster swallowed them up.

CHAPTER XXII.

Various Kinds of Lava.—Beautiful Cave in Scotland.—Crevices in Volcanoes.—Snow Under Burning Dust.

LAVA is the most important product of the volcanic fires. The various kinds of lava differ very much in their external appearance, in the color of their substance, and in the variety of their crystals, but they are all composed of silicates of alumnia or magnesia, combined with protoxide of iron, potash or soda, and lime. When the feldspathic minerals predominate, the rock is generally of a whitish, grayish or yellowish hue, and receives the name of trachyte. When the lava contains an abundance of crystals of augite, hornblende, or titaniferous iron, it is heavier, of a darker color, and often more compact; it then takes the generic formation of basalt. Numerous varieties, diversely designated by geologists, belong to this group.

Of all the lavas, trachyte is the least fluid in its form. In many places rocks of this nature have issued from the earth in a pasty state, and have accumulated above the orifice in the shape of a dome, "Just like a mass of melted wax." In this way were formed the great domes of Auvergne, the Puys de Dome and de Sarcouy. In this district the flows of trachytic lava are far inferior in length to the basaltic cheires; the most important do not exceed four or five miles in length.

At the present day, eruptions of trachyte are much more rare than those of other lavas; so much so, that certain authors class all the trachytic rocks among the formations of anterior ages. It is, however, ascertained that most of the American volcanoes and those of the Sunda Archipelago vomit out lava of this nature; the last eruptions of the Æolian Isles, Lipari and Volcano, likewise produced only trachyte and pumice-stone.

This latter substance resembles certain white, yellow, or greenish scoria, which issue like a frothy dross from the furnaces

of our iron-works, and is, like the compact trachyte, of a feldspathic nature. Some mountains are almost entirely composed of it; among others, the Monte Bianco of Lipari, which, viewed from a distance, appears as if covered with snow. Long white flows, like avalanches, fill up all its ravines, from the summit of the mountain to the shore of the Mediterranean; the slightest movement caused by the tread of an animal or a gust of wind detaches from the surface of the slope hundreds of stones, which bound down to the foot of the incline, and are borne away by the waves which bathe the base of the mountain.

In the southern part of the Tyrrhenean Sea, and especially in the vicinity of the Lipari (Æolian) Islands, the water is sometimes covered with these floating stones, almost like flakes of foam. In the Cordilleras the currents of fresh water convey the morsels of pumice to considerable distances. The River Amazon drifts down large quantities of pumice as far as its mouth, more than 3000 miles from the place where it fell into the river. Bates says that the Indians, who live too far away from the volcanoes even to know of their existence, assert that these stones, floating down the river by the side of their canoes, are surely solidified foam.

APPEARANCE OF VARIOUS LAVAS.

The external appearance of various lavas differs even more than their chemical composition. The more or less perfect state of fluidity, and the presence in them of a greater or less quantity of bubbles of vapor, give a very different texture to rocks which are composed of the same elements. Pumice-stone has the appearance of sponge; obsidian looks like black glass, and sometimes it is even semi-transparent.

It is entirely liquid, and issues from the interior of the earth like a stream flowing rapidly over the steeper slopes, and coagulating slowly in large sheets in the low ground and on the gentle inclines whither its own weight has drawn it. The surface of obsidian—for instance, that of Teneriffe—shines with a vitreous glitter; the cleavage of the rock is clean and sharp.

Some less degree of fluidity in the current of lava gives it

sometimes the appearance of resin; this is the stone which is called pechstein (pitch-stone). When the rock, issuing in a state of fusion from the bosom of the mountain, becomes still cooler, it contains innumerable perfectly-formed crystals, and only owes its fluidity to the particles of vapor in its pores. The external layer of the lava is also immediately covered with scoria which float in flakes on the fiery stream. These scoria, too, assume a great variety of shapes; some are mammillated, others are exceedingly rough and irregular.

In the Djebel-Hauran, near the crater of Abu-Ganim, there is an infinity of needles of red lava, about a yard high on the average, and bent in various directions toward the surface of the plateau; one might often fancy them flames half beaten down under the pressure of the wind. According to M. Wetzstein, these strange stone needles proceed from an eruption of flaky lava. In the Sandwich Islands, and in the Island of Réunion, certain crystals of a ferruginous appearance are grouped at the outlet of the crater in herbaceous forms of the most curious and sometimes elegant character.

RESEMBLE HEMP TOW.

Some of the products of the volcano of Mauna-Loa and Kilauea resemble the tow of hemp! These are the whitish filaments which are sometimes carried away by the wind; the Kanakes used to consider them as the hair of Pélé, the goddess of fire.

Among the old basaltic lavas there are some to which the name of "basalt" is more specially applied, which present a columnar disposition with wonderful regularity. These form the enormous monuments, much more imposing than those of man, which seem as if they had been constructed by giant builders, turning their mighty hands to the noble art of architecture, which is still practiced, though on a smaller scale, by us their feeble descendants. These magnificent colonnades of basalt are everywhere attributed to giants.

In Ireland, on the coast of Antrim, the summits of 40,000 prisms, leveled pretty regularly by the waves of the sea, and resembling a vast paved quay, have received the name of the

Giant's Causeway. In Scotland, the beautiful cave of the Isle of Staffa, hollowed out by the action of the waves between two ranges of basaltic shafts, is celebrated as the work of Fingal, the demi-god. In the Sicilian Sea, the Faraglioni Isles, or Isles of the Cyclopes, situated not far from Catania, at the base of Etna, are looked upon by tradition as the rocks cast by Polyphemus on the ships of Ulysses and his companions. Many of these prisms are from 100 to 160 feet high, and are not less than from six to sixteen feet in thickness.

Near Fair Head and the Giant's Causeway some of the shafts connected with the perpendicular cliff of the headland are nearly 400 feet in height. In the Isle of Skye, some of the columns, according to M'Culloch's statement, are still higher. On the other hand, there are also colonnades in miniature, each shaft of which is not more than three quarters of an inch to an inch from the summit to the base; instances of these are found in the basalts of the hill of Morven in Scotland.

BEDS OF LAVA ARRANGED IN COLUMNS.

Some geologists have thought that basaltic columns could not be formed except under the pressure of enormous masses of water; but a comparative study of these rocks in different parts of the world has proved that several beds of lava are arranged in columns at heights considerably above the level of the sea. In this colonnade-like formation of lava there is, however, no phenomenon which is entirely peculiar to basalt. Trachyte, also, sometimes assumes this form, and M. Fouqué has discovered a magnificent instance of it in the island of Milo, in which there is a cliff composed of prismatic shafts 320 feet in height.

Masses of mud when dried in the sun, the alluvium of rivers, beds of clay or tufa, and, in general, all matter which, in consequence of the loss of its moisture, passes from a pasty to a solid state, either in a state of nature or in our manufactories and dwellings, likewise assume a columnar structure similar to that of the basaltic lava. In fact, the entire mass, when gradually losing the moisture which swelled out its substance, can not con-

tract so as to shift the position of all its particles toward the centre; certain points remain fixed, and round each of these the contraction of a portion of the mass takes place.

In basalt, in particular, it is the lower layer which assumes the columnar structure, for these alone cool gently enough to allow the phenomena of contraction to follow the normal course. The highest portion of the mass, being deprived, immediately after its issue from the earth, of the caloric and the steam which filled its pores, is almost immediately transformed into a more or less rough and cracked mass. But this very crust protects the rest of the lava against any radiation, and serves as a covering to the semi-crystalline columns which, by the continual contraction of their particles, are slowly separated from the rest of the mass.

A FOREST OF PRISMS.

When a section of a bed of basaltic lava has been laid bare by the water of a river, the waves of the ocean, or earthquake, the rough stones of the top layers may be seen lying, with or without any gradual transition, on a forest of prisms, sometimes rudimentary in their shape, but often no less regular in their shape than if they had been carved out by the hand of man. Most are of a hexagonal form; others, which were probably subject to less favorable conditions, have four, five or seven faces; but all are definitely separated from one another by their particles gathering round the central axis.

Mr. Poulett Scrope describes a fact which proves the enormous power of this contractile force. The colonnade of Burzet in Vivarais, contains numerous nodules of olivine, many of which are as large as a man's fist: and, in spite of their extreme hardness, have been divided into two pieces, each fixed in one of two adjacent columns. Although the two corresponding surfaces have been polished by the infiltration of water, it is impossible to doubt that the two separate portions were not once joined in the same nodule.

As natural philosophers have verified by experiments on various viscous substances, basaltic shafts are always formed per-

pendicularly to the surface of refrigeration. Now, this surface being inclined, according to the locality, in a diversity of ways, the result is, that the columns may assume a great variety of directions in their position. Although most of them are vertical, on account of the cooling taking place in an upward direction, others, as at St. Helena, take a horizontal direction, and resemble trunks of trees heaped upon a wood-pile.

In other places, as at the Coupe d'Ayzac in Auvergne, the columns of a denuded cliff are arranged in the form of a fan, so as to lean regularly on the wall of the cliff as well as on the ground of the valley. At Samoskœ, in Hungary, a sheet of columnar basalt, very small at its origin, spreads out from the top of a rock like the water of a cascade, and hangs suspended over a precipice, resembling a cupola which has lost its base. Elsewhere masses of basaltic pillars radiate in every direction like the weapons in an immense trophy of arms.

LIKE GIGANTIC BAMBOOS.

An exact prismatic form, is not, however, the only shape assumed by the cooling lava. The phenomenon of contraction takes place in different ways, according to the nature of the erupted matter, the declivity of the slopes, and all the other surrounding circumstances. Thus, in consequence of the sinking of the rock, most basaltic prisms exhibit at intervals a kind of joint, which gives the columns a kind of resemblance to gigantic bamboos. In some lavas these joints are so numerous, and the edges of the stone are so eaten away by the weather, that the shafts are converted into piles of spheroids of a more or less regular form.

At the volcano of Bertrich, in the Eifel, one might fancy them a heap of cheeses; whence comes the name of "Cheese Cave," which is given to one of the caverns which opens in the flow of the lava. Sometimes, too, crystals scattered about in the midst of the mass have served as nuclei to globular concretions formed of numerous concentric layers. Lastly, many currents of molten matter present a tabular or schistose structure, caused, like that of slate, by the pressure of the superincumbent masses.

Although lava, when cooled, is easy enough to study, it is more difficult to observe with any exactitude the molten matter immediately on its exit from the craters or fissures; besides this, the opportunities for study which are afforded to savants are sometimes very dangerous. Long years often elapse before an enquirer can notice at his ease, and without fear of sudden explosions, the mouths of Ætna or Vesuvius filling up to the brink with boiling lava.

Stromboli is the only volcano in Europe in which this phenomenon occurs regularly at closely-recurring intervals, sometimes of only five minutes, or even more frequently. When an observer stands on the highest edge of the crater, he sees, about 300 feet below him, the waves of a matter which shines like molten iron, and tosses and boils up incessantly; sometimes it swells up like an enormous blister, which suddenly bursts, darting forth eddies of vapor accompanied by solid fragments.

HAS BOILED FOR CENTURIES.

For centuries past the lava has never ceased to boil in the cavity of Stromboli, and it is but very rarely that a period of even a few hours lapses without molten matter overflowing. Thus the crater, which, during the day, is white with steam, and during the night red with the glare of the lava, has served as a light-house for mariners ever since the first vessel ventured upon the Tyrrhenian Sea.

In Nicaragua, to the north of the Great Lake, the volcano of Masaya (or "Devil's Mouth") presents a spectacle similar to that of Stromboli, but grander, and perhaps still more regular. After having remained in a state of repose for nearly two centuries, from 1670 to 1853, the monster—which has received the name it bears from the frightful turbulence of its burning waves—resumed all its former activity. In this crater the enormous bubbles of lava, which ascend from the bottom of the abyss and throw out a shower of burning stones, break forth in a general way every quarter of an hour.

The volcano of Isalco, not far from Sonsonate, in the State of

San Salvador, is also one of the most curious on account of its regularity. Its first breaking out was noticed on the 29th of March, 1783, and since this date it has almost always continued to increase in size by throwing outside its cavity ashes and stones. Some of its eruptions, remarkable for their comparative violence, have been accompanied by flows of lava; but, generally, the crater of Isalco confines itself to hurling burning matter to a height of 39 to 46 feet above its crater; explosions follow one another at intervals of every two minutes. The total elevation of the cone of debris above the village of Isalco being 735 feet, and the slope of the side of the mass being, on the average, 35 degrees, M. von Seebach, one of the observers of the volcano, has been able to calculate approximately the bulk and regular increase of the mountain. In 1865 the mass of debris was about 35,000,000 of cubic yards, giving an increase of about 491,000 cubic yards every year, or 56 cubic yards every hour. The volcano, therefore, might be looked upon as a gigantic hour-glass.

WORLD-RENOWNED CRATER.

Of all the craters in the world, the one which most astonishes those who contemplate it is the crater of Kilauea, in the island of Hawaii. This volcanic outlet opens at more than 3900 feet of elevation on the sides of the great mountain of Mauna-Loa, which is itself crowned by a magnificent funnel-shaped crater 2735 yards across from one brink to the other. The elliptical crater of Kilauea is no less than three miles in length and seven miles in circumference. The hollow of this abyss is filled by a lake of lava, the level of which varies from year to year, sometimes rising and sometimes falling like water in a well.

In a general way, it lies about 600 to 900 feet below the outer edge, and, in order to study its details, it is necessary to get on to a ledge of black lava which extends round the whole circumference of the gulf; this is the solidified edge of a former sheet of molten matter, similar to those circular benches of ice which, in northern countries, border the banks of a lake, and even in spring still mark the level the water has sunk from. The surface

of the sea of fire is generally covered by a thick crust over its whole extent; here and there the red lava-waves spring up like the water of a lake through the broken ice. Jets of vapor whistle and hiss as they escape, darting out showers of burning scoria, and forming cones of ashes on the crust 60 to 100 feet in height, which are so many volcanoes in miniature.

Intense heat radiates from the immense crater, and a kind of hot blast makes its way through all the chinks in the vertical walls of the sides. In the midst of the hot vapors, one feels as if lost in a vast furnace. During the night time an observer might fancy himself surrounded with flames; the atmosphere itself, colored by the red reflection of the vent holes of the volcano, seems to be all on fire.

RUSHES THROUGH THE OPENING.

The level or the fire lake of Kilauea is incessantly changing. In proportion as fresh lava issues forth from the subterranean furnace, the broken crust affords an outlet to other sheets of molten matter and fresh heaps of scoria, and gradually the boiling mass rises from ledge to ledge, and ultimately reaches the upper edge of the basin. Sooner or later, however, the level rapidly sinks. The fact is, that the burning mass contained in the depths of the abyss gradually melts the lower walls of solid lava; these walls ultimately give way at some weak points in their circumference, a crevice is produced in the outer face of the volcano, and the liquid matter, "drawn off" like wine from a vat, rushes through the opening made for it.

The flow increases the orifice by the action of its weight on the sill of the opening, and by melting the rocks which oppose its passage, and then, running down over the slopes, flows into the sea, forming promontories on the shore. In 1840 the crater was full to the brink, when a crack suddenly opened in the side of the mountain. This fissure extended to a distance of 131 feet from its starting-point, and vomited forth a stream of lava 37 miles long and 16 miles wide, which entirely altered the outline of the sea-coast, and destroyed all the fish in the adjacent waters. Mr.

Dana estimated the total mass of this enormous flow as equal to 7,200,000 cubic yards—that is, to a solid body fifty times as great as the quantity of earth dug out in cutting through the Isthmus of Suez.

The enormous basin of Kilauea, 1476 feet deep, remained entirely empty for some time, and the former lake of lava left no other trace of its existence than a solid ledge like those which had been formed at the time of previous eruptions. Since this date the great cauldron of lava has been several times filled and several times emptied, either altogether or in part.

OUTLET FOR OVERFLOW.

Almost all the volcanoes which rise to a great height, get rid, like Kilauea, of their overflow of lava through fissures which open in their side walls. In fact, the column of molten matter which the pressure of the gas beneath raises in the pipe of the crater is of an enormous weight, and every inch it ascends toward the mouth of the crater represents an expense of force which seems prodigious. The more or less hypothetical calculations which have been made as to the degree of pressure necessary for the steam to be able to act on the lava-furnace lead to the belief that the outlet-conduits of volcanoes, and consequently the mass of liquid stone to be lifted, are not less than nine miles in depth. Various geologists—among others Sartorius von Waltershausen, the great explorer of Etna—believe that the volcano-shafts are of a still more considerable depth. The rocks of the terrestrial surface, limestone, granite, quartz, or mica, are of a specific gravity two and a half times superior to that of water, while the planet itself, taken as a whole, weighs nearly five and a half times as much as the same mass of distilled water; the density of the interior layers must therefore increase from the circumference to the center. With regard to the proportion of this increase, it is established by a calculation, the whole responsibility of which must rest upon its authors. Baron Waltershausen has ascertained, by means of a great number of weighings, that the lava of Etna and that of Iceland have a specific gravity of 2.911.

The presumed consequence of this fact is that the rocks thrown out by the volcanoes of Sicily and Iceland proceed from a depth of seventy-seven to seventy-eight miles (?). Thus the shaft which opens at the bottom of the crater of Etna would be no less than seventy-seven miles deep, and the lava which boils in this abyss would be lifted by a force of 36,000 atmospheres, an idea altogether incomprehensible by our feeble imaginations. There would, then, be nothing astonishing in the fact that a mass of lava, which is sufficiently heavy to balance a pressure of this kind, should, in a great many eruptions, melt and break through the weaker parts of its walls, instead of ascending some hundreds or thousands of feet higher, so as to run out over the edge of the upper crater.

When the side of the mountain opens, and affords a passage to the lava, the fissure is always perceptibly vertical, and those which are continued to the summit pass through the very mouth of the volcano. In a general way, these fissures of eruption are of considerable length, and are sufficiently wide to form an impassable precipice. Before these fissures become obliterated by the lava or by other debris—such as the snow and earth of avalanches—they may be traced out by the eye as deep furrows hollowed out on the mountain side.

DEPRESSIONS FILLED WITH SNOW.

In 1669 the lateral fissure of Ætna extended over more than two-thirds of the southern side—from the plains of Nicolosi to the terminal gulf of the great crater. In like manner, in the Isle of Jan Mayen, the volcano of Beerenberg, 7514 feet high, presents from top to bottom a long depression filled up with snow, which is nothing else than a fissure of eruption. On other mountains, especially in Montserrat, Guadeloupe, and Martinique, these fissures have assumed such dimensions that the peaks themselves have been completely split in two.

Through outlets of this kind the lava jets out, first making its appearance at the upper part, where the declivity is generally steeper, then springing out below on the more gentle slopes of the lower regions of the mountain.

At the source itself the lava is altogether fluid, and flows with considerable speed—sometimes, on steep slopes, faster than a horse can gallop; but the course of the molten stone soon slackens, and the liquid, hitherto dazzling with its light, is covered by brown or red scoria, like those of iron just come out of a furnace. These scoria come together, and, combining, soon leave no interstices between them beyond narrow vent-holes, through which the molten matter escapes. The scoria then form a crust, which is incessantly breaking with a metallic noise, but gradually consolidates into a perfect tunnel round the river of fire; this is the cheire, thus named on account of the asperities which bristle on its surface.

STANDING ON A THIN SURFACE.

Any one may safely venture on the arch-shaped crust, although only a few inches above the mass in state of fusion, without any fear of being burnt, just as in winter we trust ourselves on the sheets of ice which cover a running stream. The pressure of the lava succeeds in breaking through its shell only at the lower parts of its flow, in spots where the waves of burning stone fall with all their weight. Then the envelope is suddenly ruptured and the mass springs out like water from a sluice, pushing before it the resounding scoria, and swelling out gently in the form of an enormous blister; it then again becomes covered with a solid crust, which is again broken through by a fresh effort of the lava.

Thus the river, surrounding itself with dikes, which it constantly breaks through, gradually descends over the slopes, terrible and inexorable, so long as the original stream does not cease to flow. The only means of diverting the current is to modify the incline in front of it, either by opposing obstacles to it to throw it to either side, or by preparing a road for it by digging deep trenches, or by opening up above some lateral outlet for the pent-up lava. In 1669, at the time of the great eruption which threatened to swallow up Catania, all these various means were adopted in order to save the town. On one side the inhabitants

worked at consolidating the rampart, and placed obstacles across the path of the current to turn it toward the south.

Other workmen, furnished with shovels and mattocks, ascended along the edge of the flow, and, in spite of the resistance offered by the peasants, tried to pierce through the shell of scoria, and thus, by tapping the stream, to open fresh outlets for the molten matter. These means of defense partly succeeded, and the terrible current which, at its source near Nicolosi, had been able to melt and pierce through the volcanic cone of Monpilieri at its thickest point (this cone standing in its path) was turned from its course toward the centre of Catania, and destroyed nothing but the suburbs.

The radiation from the lava being arrested by the crust of scoria, which is a very bad conductor of heat, the temperature of the air surrounding a flow of lava rises but very slightly. The Neapolitan guides have no fear in approaching the Vesuvian lava in order to stamp the rough medals made of it, which they sell to foreigners. At a distance of a few yards from the vent-holes in the cheire the trees of Etna continue to grow and blossom, and some clumps, indeed, may be seen flourishing on an islet of vegetable earth lying between two branches of a flow of burning lava. And yet, by a contrast which at first sight seems incomprehensible, it sometimes happens that trees which are distant from any visible flow of molten matter suddenly wither and die.

VINEYARDS BLIGHTED.

Thus, in 1852, at the time of the great eruption from the Val del Bove, on the eastern slopes of Mount Etna, vineyards and vines, covering a considerable area, and situated at a distance of more than half a mile below the front of the flow, were suddenly dried up, just as if the blast of a fire had burnt up their foliage. In order to explain this curious phenomena, it is necessary to admit that some rivulets of the great lava river must have penetrated under the earth through the fissures of the soil, and have filled up a subterranean cavity in the mountain exactly below the vineyards that were destroyed; the roots being con-

sumed, or deprived of the necessary moisture, the trees themselves could not do otherwise than perish.

On lofty mountains in a state of eruption, the masses of snow and ice, which are covered by the fiery currents which issue from the volcanic fissures, do not always melt, and some have been preserved under the scoria for centuries, or even thousands of years. Lyell has discovered them under the lava of Etna, American geologists under the masses thrown out by the crater of Mount Hooker, Darwin under the ashes in Deception Island, in the Terra del Fuego, M. Philippi under the flows of the volcano Nuevo de Chillan, which in 1861 erupted through a glacier.

There every bed of snow which falls during the winter remains perfect under the coat of burning dust which is ejected from the outlet of eruption, and sections made through the mass of debris show for a great depth the alternate black and white strata of the volcanic ashes and the snow. In 1860 the crater of the mountain of Kutlagaya, in Iceland, hurled out simultaneously into the air lumps of lava and pieces of ice all intermingled together.

BURIED LAVA STILL BURNING.

In like manner, the immense flows of lava in Iceland have left in a perfect state of preservation the trunks of the Sequoias, and other American trees, which adorned the surface of the island during the ages of the Tertiary epoch, at a time when the mean temperature of this country was 48° (Fahr.); that is, 42° to 44° above that which it is at present. Although the radiation from the lava is so slight that it neither melts the ice nor burns the trunks of buried trees, yet, on the other hand, the heat and fluidity of the lava are maintained in the central part of the flow for a very considerable number of years. Travelers state that they have found deeply buried lava which was still burning after it had remained for a century on the mountain side.

Although the lava covers up and often preserves the snow and the ice, which are doubtless defended against the heat by a cushion of spheroidal particles of humidity, it immediately converts into steam the water with which it comes in contact. The

liquid mass, being suddenly augmented to about 1800 times its former volume, explodes like an enormous bombshell, and hurls away, like projectiles, all the objects which surround it. A serious occurrence of this kind is recorded, which took place in 1843, a few days after the formation of a fissure in Mount Etna, from which a current of molten matter issued, making its way toward the plain of Bronte.

A crowd of spectators, who had come from the town, were examining from a distance the threatening mass, the peasants were cutttng down the trees in the fields, others were carrying off in haste the goods from their cottages, when suddenly the extremity of the flow was seen to swell up like an enormous blister, and then to burst, darting forth in every direction clouds of steam and volleys of burning stones. Everything was destroyed by this terrible explosion—trees, houses and cultivated ground ; and it is said that sixty-nine persons, who were knocked down by the concussion, perished immediately, or in the space of a few hours.

LIKE GUNPOWDER.

This disaster was occasioned by the negligence of an agriculturist, who had not emptied the reservoir on his farm ; the water, being suddenly converted into steam, had caused the lava to explode with all the force of gunpowder.

The quantity of molten matter which is ejected by a fissure in one single eruption is enormous. It is known that the current of Kilauea, in 1840, exceeded 6550 millions of cubic yards. That which proceeded from Mauna-Loa, in 1835, produced a still larger quantity of lava, and extended as far as a point seventy-six miles from the crater. Flows of this kind are certainly rare ; but there are some recorded in the earth's history which are still more considerable. Thus the volcano of Skaptar-Jokul, in Iceland, was cleft asunder in 1873, and gave vent to two rivers of fire, each of which filled up a valley ; one attained a length of fifty miles, with a breadth of fifteen miles ; the other was of less dimensions, but the depth of the mass was in some places as much as 492 feet. A subterranean fissure, ninety-nine miles in length, which

cleaves in two the ground of Iceland, was doubtless filled up with lava along its entire length, for hillocks of eruption sprung up on various points of this straight line.

It has been calculated that the whole of the lava evacuated by the Skaptar in this great eruption was not less in bulk than 655,000 millions of cubic yards, a mass equivalent to the whole volume of Mont Blanc; it would be a quantity sufficient to cover the whole earth with a film of lava 0.0393 inch in thickness. As to the celebrated flow from the Monti Rossi, which threatened to destroy Catania, in 1669, it seems very trifling in comparison; it contained a mass of molten stone which was estimated at 1310 millions of cubic yards. On how trifling a scale, therefore, are these ordinary eruptions compared with the surface of the globe! They are, however, phenomena perceptible enough to man, in all his infinite littleness.

CHAPTER XXIII.

VOLCANIC PROJECTILES.—EXPLOSIONS OF ASHES.—SUBORDINATE VOLCANOES.—MOUNTAINS REDUCED TO DUST.—FLASHES AND FLAMES PROCEEDING FROM VOLCANOES.

THE lava swelling up in enormous blisters above the fissures from which it flows in a current over the slopes is far from being the only substance ejected from volcanic mountains. When the pent-up vapor escapes from the crater with a sudden explosion, it carries with it lumps of molten matter, which describe their curve in the air, and fall at a greater or less distance on the slope of the cone, according to the force with which they were ejected.

These are the volcanic projectiles, the immense showers of which, traced in lines of fire on the dark sky, contribute so much during the night time to the magnificent beauty of volcanic eruptions. These projectiles have already become partially cooled by their radiation in the air, and when they fall are already solidified on the outside, but the inside nucleus remains for a long time in a liquid or pasty state. The form of these projectiles is often of an almost perfect regularity.

Each sphere is in this case composed of a series of concentric envelopes, which have evidently been arranged in the order of their specific gravity during the flight of the projectile through the air. The dimensions of these projectiles vary in each eruption; some of them are one or more yards in thickness; others are nothing but mere grains of sand, and are carried by the wind to great distances.

In most eruptions, these balls of lava, still in a fluid and burning state, constitute but a small part of the matter thrown out by the mountain. The largest proportion of the stone ejected proceeds from the walls of the volcano itself, which break up under the pressure of the gas, and fly off in volleys, mingled with the products of the new eruption. This is the origin of the dust or

ashes which some craters vomit out in such large quantities, which too, are the causes of such terrible disasters.

When the impetus of the gas confines itself to forming a fissure in the side of the mountain, the fragments of rocks which are broken up and reduced to powder are compratively small in quantity. They are projected in clouds out of the fissure, and, falling like hail round the orifice, are gradually heaped up in the form of a cone on the side of the mountain from which they arose. In Europe, the enormous circumference of Etna presents more than 700 of these subordinate volcanoes, some scarcely higher than an Esquimaux hut, and others, like the Monti Rossi, Monte Minardo, Monte Ilici, several hundred yards high, and more than half a mile wide at the base.

SCANTY GROWTH OF BROOM.

There are some which are entirely sterile, or covered only by a scanty vegetation of broom, and are marked out by a red, yellow, or even black color on the main body of Etna ; those situated on the lower slopes are covered with trees or planted with vines, and sometimes contain admirable crops in the very cavity on their summit. These cones of ashes, springing up like a progeny on the vast sides of their mother mountain, give to Etna a singular appearance of vital personality and of creative energy. The same phenomenon occurs on the volcanoes of Hawaii, which carry on their declivities thousands of subordinate cones.

In the formation of these hillocks a real division of labor takes place. The rocks and heavier stones fall either on the edge of the crater or in the gulf itself. The ashes and light dust are shot up to a much greater height, and, hurried along by the impulse of the wind, fall far and wide, like the chaff of corn winnowed in a threshing-floor. Thus the slope of the cone toward which the wind directs the ashes is always more elongated, and rises to a greater height on the edge of the crater. On Etna, where the wind generally blows in the direction of west to east, the eastern slope of the hillocks is more developed than on the opposite side. It must, perhaps, be attributed to the action of the wind blowing on the

heights, and not, as Siemsen, the geologist, supposes, to the obliquity of the shaft of the crater, that all the scoria and ashes fall to the north of the orifice of the volcano Nuevo de Chillan, in Chili.

The phenomena which take place when the ashes issue from the mouth of the crater itself do not differ from those which are observed at the outlets in fissures. In the former case, however, the mass of rocks reduced to powder is so considerable that the rain of ashes assumes all the proportions of a cataclysm. It has sometimes happened that, during a paroxysm of volcanic energy, the whole summit of a mountain, for a depth of several thousands of feet, has been hurled into the air, mingled with a cloud of vapor and the smoke of burning lava.

Thus Etna, if we are to believe Ælianus, was once much loftier than it is in our time, and on the north of the present terminal cone there may, in fact, be noticed a kind of platform which seems to have been the base of a summit twice as high as the present crest. The whole of the Val del Bove is probably an empty space left by the disappearance of a former cone.

REDUCED TO POWDER.

With regard to Vesuvius, it is known that, in the year 79 of the present era, the whole of that part of the mountain which was turned toward the sea was reduced to powder, and that the debris of the cone, nothing of which now remains except the semicircular inclosure of La Somma, buried three towns and a vast extent of plain. The ashes and dust, mingled with white vapor rising in thick eddies, ascended in a column to a point far above the summit of the volcano, until, having reached those regions of the atmosphere where the rarefied air could no longer sustain them, they spread out into a wide umbrella-like shape, the falling dust of which obscured the sky.

Pliny the younger compared this vault of ashes and smoke to the foliage of an Italian pine curving at an immense height over the mountain. Since this memorable epoch the height of the column of vapor has been measured which has issued from Vesu-

vius at the time of several great eruptions, and it has been sometimes found that it reached 23,000 to 26,000 feet; that is, six times higher than the summit of the volcano itself.

One of these explosions of entire summits which caused most terror in modern times was that of the volcano of Coseguina, a hillock of about 500 feet high, situated on a promontory to the south of the Bay of Fonseca, in Central America. The debris hurled into the air spread over the sky in a horrible arch several hundreds of miles in width, and covered the plains for a distance of 25 miles with a layer of dust at least 16 feet thick. At the very foot of the hill the headland advanced 787 feet into the bay, and two new islands, formed of ashes and stones falling from the volcano, rose in the midst of the water several miles away.

PUMICE-STONE ON THE WATER.

Beyond the districts close round the crater, the bed of dust, which fell gradually, became thinner, but it was carried by the wind more than forty degrees of longitude toward the west, and the ships sailing in those waters penetrated with difficulty the layer of pumice-stone spread out on the sea. To the north, the rain of ashes was remarked at Truxillo, Honduras, and at Chiapas, in Mexico; on the south, it reached Carthagena, Santa Martha, and other towns of the coast of Grenada; to the east, being carried by the counter current of the trade-winds, it fell on the plains of St. Ann's, in Jamaica, at a distance of 800 miles. The area of land and water on which the dust descended must be estimated at 1,500,000 square miles, and the mass of matter vomited out could not be less than 65,500 million cubic yards.

The uproar of the breaking up of the mountain was heard as far as the high plateaux of Bogota, situated 1025 miles away in a straight line. While the formidable cloud was settling down round the volcano, thick darkness filled the air. For forty-three hours nothing could be seen except by the sinister light of the flashes darting from the columns of steam, and the red glare of the vent holes opening in the mountain.

To escape from this prolonged night, the rain of ashes, and

the burning atmosphere, the inhabitants who dwelt at the foot of Coseguina fled in all haste along a road running by the black water of the Bay of Fonseca. Men, women, children, and domestic animals travelled painfully along a difficult path, through quagmires and marshes. So great, it is said, was the terror of all animated beings during this long night of horror, that the animals, themselves, such as monkeys, serpents, and birds, joined the band of fugitives, as if they recognized in man a being endowed with intelligence superior to their own.

A large number of volcanoes have diminished in height, or have, indeed, entirely disappeared, in consequence of explosions, which reduced their rocks to powder, and distributed them in thick sheets on the ground adjacent. Mount Baker, in California, and the Japanese volcano of Unsen, have thus raised the level of the surrounding plains at the expense of a diminution in their own volume. In 1638, the summit of the peak of Timor, which might be seen like a light-house from a distance of 270 miles, exploded, and blew up into the air, and the water collecting, formed a lake in the enormous void caused by the explosion.

GREAT DESTRUCTION OF LIFE.

In 1815, Timboro, a volcano in the island of Sumbara, destroyed more men than the artillery of both of the armies engaged on the battle-field of Waterloo. In the island of Sumatra, 550 miles to the west, the terrible explosion was heard, and, for a radius of 300 miles round the mountain, a thick cloud of ashes, which obscured the sun, made it dark like night even at noonday. This immense quantity of debris, the whole mass of which was, it is said, equivalent to thrice the bulk of Mont Blanc, fell over an area larger than that of Germany.

The pumice-stone which floated in the sea was more than a yard in thickness, and it was with some difficulty that ships could make their way through it. The popular imagination was so deeply impressed by this cataclysm, that at Bruni, in the island of Borneo, whither heaps of the dust vomited out by Timboro, 870 miles away to the south, had been carried by the wind, they

date their years from "the great fall of ashes." It is the commencement of an era for the inhabitants of Bruni, just as the flight of Mohammed was for the Mussulmans.

The friction of the steam against the innumerable particles of solid matter which are darted out into the air is the principal cause of the electricity which is developed so plentifully during most volcanic eruptions. In consequence of this friction, which operates simultaneously at all points in the atmosphere which are reached by the volcanic ashes, and vapor, sparks flash out which are developed into lightning. The skies are lighted up not only by the reflection from the lava, but also by coruscations of light which dart from amid the clouds.

When the vast canopy of vapor spreads over the summit of the mountains, numerous spirals of fire whirl round on each side of the clouds, which, as they unroll, resemble the foliage of a gigantic tree. Doubtless, also, the encounter of two aerial currents may contribute to produce lightning in the columns of vapor; yet, when the latter are slightly mingled with ashes, they are rarely stormy.

ACTUAL FIRES SEEN.

Although the evolution of electricity in the columns of vapor and ashes vomited out by volcanoes has never been called in question, the appearance of actual flames at the time of volcanic eruptions was for a long time disputed. M. Sartorius von Waltershausen, the patient observer of Etna, has maintained that neither this mountain, nor Stromboli, nor any other volcano, has ever presented among its phenomena any fire properly so called, and that the supposed flames were nothing more than the reflection of the red or white lava that was boiling in the crater.

On the other hand, Elie de Beaumont, Abich and Pilla positively assert that they have seen light flames on the summit of Vesuvius and Etna. It would, however, be very natural to believe that inflammable gases might be liberated and take fire at the outlet of those immense shafts which place the great subterranean laboratory of lava in communication with the outer air.

This question was, however, resolved in the affirmative at the time of the eruption of Santorin, and popular opinion was right in opposition to most men of science. All those who were able to witness, at its commencement, the upheaval of the lava at Cape Georges and Aphroessa, have certified to the appearance of burning gas dancing above the lava, and even on the surface of the sea. All round the upheaved hillocks, bubbles of gas, breaking forth from the waves, became kindled as they came in contact with the burning mass, and were diffused over the water in long trains of white, red or greenish flames, which the breeze alternately raised or beat down; sometimes a smart puff of wind put out the fire, but it soon recommenced to run over the breakers; by approaching it carefully, fragments of paper might be burnt in it, which lighted as they dropped. On the slopes of the volcano of Aphroessa fire, rendered of a yellowish hue by salts of soda, sprung out from all the fissures, and rose to a height of several yards. On the rather older lava of Cape Georges the trains of flame were less numerous; there, however, bluish glimmers might be seen flitting about in some spots over the black ridges of lava.

GROWING MOUNTAINS.

Added to this, are not the flames at Bakou, on the coast of the Caspian Sea, produced by the volcanic action of the ground? The "growing mountains" in the neighborhood are mud-volcanoes, and we must doubtless attribute to the same subterranean activity the production of the hydrogen gas which burns in an "eternal flame" in the temple of the Parsi. During some of the evenings in autumn, when the weather is fine and the sun has heated the surface of the ground, the flames occasionally make their appearance on the hills, and for several hours may be seen the marvelous spectacle of a train of fire stretching along the country without burning the ground, and even without scorching a blade of grass.

Next to lava and ashes, streams of water and mud are the most considerable products of volcanic activity, and the catastrophes which they have caused are perhaps among the most terri-

ble which history has to relate. By means of these sudden deluges, towns have been swept away or swallowed up, whole districts dotted over with habitations have been flooded with mud or converted into marshes, and the entire face of nature has been changed in the space of a few hours.

The liquid masses which descend rapidly from the mountain height do not always proceed from the volcano itself. Thus the local deluge may be caused by a rapid condensation of large quantities of steam which escape from the crater and fall in torrents on the slopes. A phenomenon of this kind must evidently take place in a great many cases, and it was doubtless by a cataclysm of this kind that the town of Herculaneum, at the foot of Vesuvius, was buried.

MELTED SNOW AND ICE.

As regards the lofty snow-clad volcanoes of the tropical and temperate zones, and also those of the frozen regions, the torrents of water and debris—the "water-lava," as the Sicilians call them—may be explained by the rapid melting of immense masses of snow and ice, with which the burning lava, the hot ashes, or the gaseous emanations of the volcanic furnace have come in contact. Thus, in Iceland, after each eruption, formidable deluges, carrying with them ice, scoria, and rocks, suddenly rush down into the valleys, sweeping away everything in their course.

These liquid avalanches are the most terrible phenomena which the inhabitants of the island have to dread. They show three headlands formed of debris, which the body of water descending from the sides of Kutlugaya in 1766 threw out far into the sea, in a depth of 246 feet of water.

Other deluges no less formidable are caused by the rupture of the walls which pen back a lake in the cavity of a former crater, or by the formation of a fissure which affords an outlet to liquid masses contained in subterranean reservoirs. It would be too difficult to explain otherwise the mud-eruptions of several trachytic volcanoes of the Andes—Imbambaru, Cotopaxi, and Carahuarizo. In fact, the mud which comes down from these

mountains often contains a large quantity of organized beings, aquatic plants, infusoria, and even fish, which could only have lived in the calm waters of a lake.

Of this kind is the Pimelodes cyclopum, a little fish of the tribe of the Silurida, which according to Humboldt, has hitherto been found nowhere except in the Andini caverns and in the rivulets of the plateau of Quito. In 1691 the volcano of Imbambaru vomited out, in combination with mud and snow, so large a quantity of these remains of organisms that the air was contaminated by them, and miasmatic fevers prevailed in all the country round. The masses of water which thus rush down suddenly into the plains amount sometimes to millions, or even thousands of millions of cubic yards.

UNDERGROUND LAKES.

Although, in some cases, these eruptions of mud and water may be looked upon as accidental phenomena, they must, on the contrary, as regards many volcanoes, be considered as the result of the normal action of the subterranean forces. They are, then, the waters of the sea or of lakes which, having been buried in the earth, again make their appearance on the surface, mingled with rocks which they have dissolved or reduced to a pasty state.

A remarkable instance of these liquid eruptions is that presented by Papandayang, one of the most active volcanoes in Java. In 1792 this mountain burst, the summit was converted into dust and disappeared, and the debris, spreading far and wide, buried forty villages. Since this epoch a copious rivulet gushes out in the very mouth of the crater, at a height of 7710 feet, and runs down into the plain, leaping over the blocks of trachyte. Round the spring pools of water fill all the clefts in the rocks, and boil up incessantly under the action of the hot vapors which rise in bubbles; here and there are funnel-shaped cavities, in which black and muddy water constantly ascends and sinks with the same regularity as the waves of the sea; elsewhere, muddy masses slowly issuing from small craters flow in circular slopes over mounds of a few inches or a yard in height; lastly, jets of steam dart out of

all the fissures with a shrill noise, making the ground tremble with the shock.

All these various noises, the roaring of the cascades, the explosion of the gaseous springs, the hoarse murmur of the mud-volcanoes, the shrill hissing of the fumaroles, produce an indescribable uproar, which is audible far away in the plains, which, too, has given to the volcano its name of Papandayang, or "Forge," as if one could incessantly hear the mighty blast of the flames and the ever-recurring beating of the anvils.

In volcanoes of a great height it is rarely found that eruptions of water and mud are constant, as in the Papandayang; but temporary ejections of liquid masses are frequent, and there are, indeed, some volcanoes which vomit out nothing but muddy matter. The volcano of Aqua (or water), the cone of which is gently inclined like that of Etna, and rises to about 13,000 feet in height, into the regions of snow, has never vomited anything but water; and it is, indeed, stated that lava and other volcanic products are entirely wanting on its slopes.

INHABITANTS DRIVEN OUT.

Yet in 1541, this prodigious intermittent spring hurled into the air its terminal point and poured over the plains at its base, and over the town of Guatemala, so large a quantity of water, mingled with stones and debris, that the inhabitants were compelled to fly with the greatest haste, and to reconstruct their capital at the foot of the volcano of Fuego. This new neighbor, however, showed that he was as much or more to be dreaded than their former one, for the violent eruptions from the mountain compelled the inhabitants of the second town to again migrate and to rebuild their capital at a point twenty miles to the northwest.

Several volcanoes in Java and the Philippines also give vent, during their eruptions, to large quantities of mud, sometimes mingled with organic matter in such considerable proportions that they have been utilized as fuel. In 1793, a few months after the terrible eruption of Unsen, in the island of Kiousiou, an adjacent

volcano, the Miyi-Yama, vomited, according to Kampfer, so prodigious a quantity of water and mud that all the neighboring plains were inundated, and 53,000 people were drowned in the deluge; unfortunately, we have no historical details of this catastrophe. Of all the eruptions of mud, the best known is that of Tunguragua, a volcano in Ecuador, which rises to the south of Quito to 16,400 feet in height.

In 1797, at the time of the earthquake of Riobamba, a whole side of the mountain sank in the downfall, with the forests which grew on it; at the same time, a flow of viscous mud issued from the fissures at its base, and rushed down into the valleys. One of these currents of mud filled up a winding defile, which separated two mountains, to a depth of 650 feet, over a width of more than 1000 feet, and damming up the rivulets at their outlet from the side valleys, kept back the water in temporary lakes; one of these sheets of water remained for eighty-seven days.

A CURIOUS TRANSITION.

The volcanic mud, therefore, has this point of resemblance with the lava—that it sometimes flows out through the crater, as on Papandayang; sometimes through side craters, as on Tunguragua. Doubtless, when the volcanic muds have been better studied, we shall be enabled to trace the transition which takes place by almost imperceptible degrees between the more or less impure water escaping from volcanoes, and the burning lava more or less charged with steam. This transition is, however, already noticed in the ancient matter which the water has carried down and deposited in the strata at the foot of volcanic mountains. These rocks, known under the name of tufa, trass, or perperino, are nothing but heaps of pumice, scoria, ashes, and mud, cemented together by the water into a species of mortar or conglomerate, and gradually solidified by the evaporation of the humidity which they contained.

Of this kind, for instance, is the hardened stone which, for eighteen centuries, has covered the city of Herculaneum with a a layer of 50 to 150 feet in thickness. Among rocks of various

formations, there are but few which exhibit a more astonishing diversity than the tufas. They differ entirely in appearance and physical qualities, according to the nature of the materials which have formed them, the quantity of water which has cemented them, the greater or less rapidity with which their fall and desication take place; lastly, the number and distribution of the chinks which are produced across the dried mass, and have been filled up with the most different substances. Many kinds of tufa resemble the most beautiful marble.

LITTLE CONES.

The small hillocks, which are specially called mud-volcanoes, or salses, on account of the salts which are frequently deposited by their waters, are cones which differ only in their dimensions from the mighty volcanoes of Java or the Andes. Like these great mountains, they shake the ground, and rend it, in order to discharge their pent-up matter; they emit gas and steam in abundance, add to their slopes by their own debris, shift their places, change their craters, throw off their summits in their explosions; lastly, some of these salses are incessantly at work, while others have periods of repose and activity. In nature, transitions merge into one another so perfectly, that it is difficult to discover any essential difference between a volcano and a salse, and between the latter and a thermal spring.

Mud-volcanoes exist in considerable numbers on the surface of the earth, and, like the volcanoes of lava, the neighborhood of the sea-coast is the principal locality where we find their little cones. In Europe, the most remarkable are those which are situated at the two extremities of the Caucasus, on the coasts of the Caspian Sea, and on both sides of the Straits of Yenikale, which connect the Sea of Azof with the Black Sea On the east, the mud-springs of Bakou are especially distinguished by their combination with inflammable gases; on the west, those of Taman and Kertch flow all the year round, but especially during times of drought, pouring out large quantities of blackish mud. One of these mud-volcanoes, the Gorela, or Kuku-Oba, which, in the

time of Pallas, was called the "Hell," or Prekla, on account of its frequent eruptions, is no less than 246 feet in height, and from this crater, which is perfectly distinct, muddy streams have flowed one of which was 2624 feet long, and contained about 850,000 cubic yards.

The volcanitos of Turbaco, described by Humboldt, and the maccalube of Girgenti, which have been explored, since Dolomieu, by most European savants who have devoted themselves to the study of subterranean forces, are also well-known examples of mud-springs, and may serve as a type to all the hillocks of the same character. In winter, after a long course of rains, the plain is a surface of mud and water forming a kind of boiling paste, from which steam makes its escape with a whistling noise; but the warmth of spring and summer hardens this clay into a thick crust, which the steam breaks through at various points and covers with increasing hillocks. At the apex of these cones a bubble of gas swells up the mud like a blister, and then bursts it, the semi-liquid flowing in a thin coat over the mound; then a fresh bubble ejects more mud, which spreads over the first layer already become hard, and this action continues incessantly until the rains of winter again wash away all the cones.

DEPENDENT ON THE TIDES.

This is the ordinary course of action of the salse, sometimes interrupted by violent eruptions. On the coast of Mekran the mud-volcanoes are not only subject to the action of the seasons, but also depend on the action of the tides, although many of them are from 9 to 12 miles from the Indian Ocean. At the time of the flow the mud rises in great bubbles, accompanied by a hoarse murmur, like the distant roar of thunder. The highest cone is not more than 246 feet high, and stands seven miles from the shore.

In a general way, the expulsion of mud and gas is accompanied by a discharge of heat, but in some salses, like those of Mekran, the matter ejected is not higher in temperature than the surrounding air, as if the expulsion of the mud from the ground was an entirely superficial phenomenon. Occasionally, in peat

bogs, the ground cracks and cold mud is ejected from the fissure; and then, after this kind of eruption, the spongy soil sinks and again levels down. Is this eruptive phenomenon similar to that presented by the mud volcanoes, and caused by the fermentation of gases in the midst of substances in a state of putrefaction? This is M. Otto Volger's idea; and it would be difficult to give any other explanation of the phenomenon.

CHAPTER XXIV.

Volcanic Thermal Springs. — Geysers. — Springs in New Zealand.—Craters of Carbonic Acid.

VOLCANOES, both of lava and mud, all have, either on their sides or in the vicinity of their base, thermal springs, which afford an outlet to their surplus water, gas, and vapor. Most even of those mountains which are at present tranquil, but which were once centres of eruption, continue to manifest their activity by vapors and gas, like furnaces in which the flames are extinct, but the smoke is still rising. Although lava and ashes no longer make their escape from the crater of lateral fissures, yet numerous hot springs, formed by the condensation of the steam, generally serve as a vehicle for the gas pent up in the depths of the mountain.

We may reckon by hundreds and thousands the "geysers," the "vinegar springs," and other thermal springs in countries once burning with volcanoes, the fires of which are extinct, or at least quieted down for a period more or less protracted. Thus the former volcanoes of Auvergne; the mountains of the Eifel, on the Rhine, the craters of which contain nothing but lakes or pools; the Demavend, with its mouth filled up with snow—all still exhale here and there, through springs, as it were, a feeble breath of their once mighty vitality.

The volcanic regions of the earth where thermal springs gush out, are very numerous. In Europe we have Sicily, Iceland, Tuscany, and the peninsula of Kertch, and Yellowstone Park, in America—land so rich in volcanoes—the springs warmed by subterranean vapor are still more numerous, and there are some on the sides of the volcano Nuevo del Chillan which gush out through a thick bed of perpetual snow.

A lateral gorge of the valley of Napa, in California, called the "Devil's Canyon," may be quoted as one of the most striking examples of the active production of thermal waters. The narrow

ravine, filled with vapor rising in eddies, opens on the side of a red and bare mountain, that one might fancy was scorched by fire. The entry to the ravine follows the course of a rivulet, the boiling waters of which are mingled with chemical substances horrible to the taste. Innumerable springs—some sulphurous, others charged with alum or salt—gush out at the base of the rocks. There are both warm and cold springs, and hot and boiling; some are blue and transparent, others white, yellow or red with ochre. In a cavity which is called the "Sorcerers' Caldron" a mass of black and fetid mud boils up in great bubbles.

Higher up, the "Devil's Steam-boat" darts out jets of gaseous matter, which issue puffing from a wall of rock: fumerolles may be seen by hundreds on the sides of the mountain. All these various agents either murmur, whistle, rumble or roar, and thus a tempest of deafening sounds incessantly fills the gorge. The burning ground, composed of a clayey mud—in one spot yellow with sulphur, and in another white with chalk—gives way under the feet of the traveler who ventures on it, and gives vent to puffs of vapor through its numberless cracks. The whole gorge appears to be the common outlet of numerous reservoirs of various mineral waters, all heated by some great volcanic furnace.

THE DEVIL'S CANYON.

The ravine of Infernillo (Little Hell), which is situated at the base of the volcano of San Vincente, in the centre of the Republic of San Salvador, presents phenomena similar to those of the "Devil's Canyon." There, too, a multitude of streams of boiling water gush from the soil, which is calcined like a brick, and eddies of vapor spring from the fissures of the rock with a noise like the shrill whistle of a locomotive. The most considerable body of water issues from a fissure 32 feet in width which opens under a bed of volcanic rocks at a slight elevation above the bottom of the valley.

The liquid stream, partially hidden by the clouds of vapor which rise from it, is shut out to a distance of 130 feet as if by a force-pump, and the whistling of the water pent up between the

rocks reminds one of the furnace of a manufactory at full work. One might fancy that it was the respiration of some prodigious being hidden under the mountain.

The hottest springs which gush out on the surface of the ground, such as those of Las Trincheras and Comangillas, do not reach the temperature of 212° (Fahr.); but we have no right to conclude from this that the water in the interior of the earth does not rise to a much more considerable heat. It is, on the contrary, certain that water descending into the deepest fissures of the earth although still maintaining a liquid state, may reach, independently of any volcanic action, a temperature of several hundred degrees; being compressed by the liquid masses above it, it is not converted into steam. At a depth which is not certainly known, but which various savants have approximately fixed at 49,000 feet, water of a temperature exceeding 750° (Fahr.) ultimately attains elasticity sufficient to overcome the formidable weight of 1500 atmospheres which presses on it; it changes into steam, and in this new form mounts to the surface of the earth through the fissures of the rocks.

FRESH JETS OF STEAM.

Even if this steam, passing through beds of a gradually decreasing temperature, is again condensed and runs back again in the form of water, still it heats the liquid which surrounds it, and increases its elasticity; it consequently assists the generation of fresh jets of steam, which likewise rise toward the upper regions. Thus, step by step, water is converted into steam up to the very surface of the earth, and springs out from fissures.

In Iceland, California, New Zealand and several other volcanic regions of the world, jets of steam mingled with boiling water are so considerable as to rank among the most astonishing phenomena of the planet. The most celebrated, and certainly the most beautiful, of all these springs is the Great Geyser of Iceland. Seen from afar, light vapors, creeping over the low plain at the foot of the mountain of Blafell, point out the situation of the jet of water and of the neighboring springs. The basin of siliceous stone

which the Geyser itself has formed during the lapse of centuries is no less than fifty-two feet in width, and serves as the outer inclosure of a funnel-shaped cavity, seventy-five feet deep, from the bottom of which rise the water and steam. A thin liquid sheet flows over the edges of the basin, and descends in little cascades over the outer slope.

The cold air lowers the temperature of the water on the surface, but the heat increases more and more in all the layers beneath; every here and there bubbles are formed at the bottom of the water, and burst when they emerge into the air. Soon bodies of steam rise in clouds in the green and transparent water, but, meeting the colder masses on the surface, they again condense. Ultimately they make their way into the basin, and cause the water to bubble up; steam rises in different places from the liquid sheet, and the temperature of the whole basin reaches the boiling-point; the surface swells up in foamy heaps, and the ground trembles and roars with a stifled sound. The cauldron constantly gives vent to clouds of vapor, which sometimes gather round the basin, and sometimes are cleared away by the wind.

LEAP OUT WITH A CRASH.

At intervals, a few moments of silence succeed to the noise of the steam. Suddenly the resistance is overcome, the enormous jet leaps out with a crash, and, like a pillar of glittering marble, shoots up more than 100 feet in the air. A second and then a third jet rapidly follow; but the magnificent spectacle lasts but for a few minutes. The steam blows away; the water, now cooled, falls in and round the basin; and for hours, or even days, a fresh eruption may be waited for in vain. Leaning over the edge of the hole whence such a storm of foam and water has just issued, and looking at the blue, transparent, and scarcely-rippled surface, one can hardly believe, says Bunsen, in the sudden change which has taken place.

The slight deposits of siliceous matter which are left by the evaporation of the boiling water have already formed a conical hillock round the spring, and, sooner or later, the increasing curb

of stone will have so considerably augmented the pressure of the liquid mass in the spring that the waters must ultimately open a fresh outlet beyond the present cone. From the experiments and observations made by Forbes as to the formation of the layer of incrustations round the jet, this spring must have commenced its eruptions ten centuries and a half ago, and they will probably cease in a much shorter space of time.

Not far from the Geyser, the mound of deposits from which is not less than 39 feet in height, there are a number of pools which once acted as basins for springs which gushed up through them, but are now nothing but cisterns filled with blue and limpid water, at the bottom of which may be seen the mouth of a former channel of eruption. A shifting in the position of the centre of activity takes place in the Geyser, just as in mud volcanoes and incrusting springs. Several springs lying on the same terrestrial fissure as the great jet d'eau, the Strokkr, the Small Geyser, and some others, present phenomena which are nearly similar, and are evidently subject to the action of the same forces.

IN CONTACT WITH HOT LAVA.

The vicinity of the active volcanoes of Iceland warrants us, however, in supposing that the water produced by the melting of the snow on Blafell does not require to descend many thousands of yards into the earth in order to be converted into steam. There is no doubt that, at no very great depth below the surface, they come in contact with burning lava, which gives them their high temperature. By reproducing in miniature all the conditions which are thought to apply to the Icelandic springs—that is, by heating the bases of tubes of iron filled with water and surmounted by a basin—Tyndall succeeded in producing in his laboratory charming little geysers, which jetted out every five minutes.

About the centre of the northern Island of New Zealand the activity of the volcanic springs is manifested still more remarkably even than in Iceland. On the slightly winding line of fissure which extends from the southwest to the northeast, between the ever active volcano of Tongariro and the smoking island of

Whakari, in Plenty Bay, thermal springs, mud fountains, and geysers rise in more than a thousand places, and in some spots combine to form considerable lakes.

In some localities the hot vapors make their escape from the sides of the mountains in such abundance that the soil is reduced to a soft state over vast surfaces, and flows down slowly to the plains in long beds of mud. For a distance of more than a mile a portion of the Lake of Taupo boils and smokes as if it was heated by a subterreanean fire, and the temperature of its water reaches, on the average to 100° (Fahr.). Farther to the north, the two sides of the valley, through which flows the impetuous river of Waikato after its issue from Lake Taupo, present, for more than a mile, so large a number of water jets, that in one spot as many as seventy-six are counted. These geysers, which rise to various heights, play alternately, as if obeying a kind of rhythm in their successive appearances and disappearances.

While one springs out of the ground, falling back into its basin in a graceful curve bent by the wind, another ceases to jet out. In one spot a whole series of jets suddenly become quiet, and the basins of still water emit nothing but a thin mist of vapor. Farther on, however, the mountain is all activity; liquid columns all at once shine in the sun, and white cascades fall from terrace to terrace toward the river. Every moment the features of the landscape are being modified, and fresh voices take a part in the marvelous concert of the gushing springs.

About the middle of the interval which separates the Lake of Taupo from the coast of Plenty Bay, several other volcanic pools are dotted about, all most remarkable for their thermal and jetting springs. One of them, however, is among the great wonders of the world. This is the Lake of Rotomahanna, a small basin of about 120 acres, the temperature of which, being raised by all the hot springs which feed it, is about 78° (Fahr.). Dr. von Hochstetter has not even attempted to count the basins, the funnels, and the fissures from which the water, steam-mud, and sulphurous gases make their escape.

APPENDIX.

THE later scenes of devastation and horror in the earthquake-convulsed city of San Francisco were such as might have been expected from the destruction and terror that had gone before. And what went before was graphically described by a railway clerk.

Caught by the first awful shock of the earthquake in a street car at Sixteenth and Mission Streets, while on his way to report "out" at the general postoffice, and forced to grope his way through the debris-strewn streets from there to the ferry house, C. E. Presson, railway mail clerk. Told a most graphic story.

"I was at Sixteenth and Mission Streets on a street car when the shock came. It was at 5.15 o'clock, as nearly as I can tell. I was headed for the postoffice, as I was due to go out on my run on No. 8 on the Southern Pacific. There was one great detonating roar, a succession of frightful crashes, and then came the flames, breaking out everywhere.

"The shock set all of the passengers in a panic, myself among the rest. The cars were stopped at once. We all got off and tried to walk, but couldn't make any headway while the shock lasted. It seemed to come from east to west, and then from north to south, and there was also a vertical motion. It came as a thunderbolt to me. There was no oppression in the atmosphere and there was absolutely no warning. The first shock, I should say, lasted about two minutes. When the shock came there was a noise as though a cannon had exploded. This was made by falling walls and houses. We also heard the crashing of glass as it was hurled from the windows to the pavement.

"We started to walk down Mission Street. I went as far as the postoffice, at Seventh and Mission Streets. As I walked on women were in the street clad only in their nightclothes and calling for their little ones amidst their tears. Men were rushing through half-fallen buildings and throwing clothing to the women in the streets from the upper windows. It was a terrible sight. When I got to the postoffice I entered the mailing department to go to my office and register 'out' on train 8.

"In going through the building I saw that all of the beautiful marble work on the staircase had been broken into a thousand pieces. The building had sunk so that I could not get through the doors in the interior. The plastering was all down in the mailing room and the custodian of the building had been injured about the head by falling debris. The office was abandoned at 6 A. M. I went from the postoffice down Mission Street to Sixth. At Sixth and Howard Streets a big rooming house had collapsed and was a mass of flames. The bystanders told me that there were 250 people in the ruins. There was no chance to aid them.

"I turned there and went to Market Street. Going down that street I saw that every conveyance on the street was loaded with the dead and injured, taking them to the emergency morgue and hospital. By this time it was nearly 6 o'clock. Market Street, as I looked toward the ferry, was a mass of brick and stone debris from fallen walls. The street itself was sunken in some places and raised in others, so that it looked like the waves of the ocean. The depressions were at right angles to the street.

MARKET STREET A MASS OF DEBRIS.

"The Call building was twisted slightly. The rear end of the Examiner building, toward the Palace Hotel, had partially fallen in. The new Monadnock building, not yet finished, that is between the Examiner and the Palace Hotel, seemed to have been cut in two. That portion toward the Examiner had collapsed and was in ruins. The Palace Hotel, as I saw it, was leaning about thirty degrees toward Montgomery Street. All of the guests were crowded in the street, but all seemed to have had time to dress. The new portion of the Chronicle building had fallen in, as far as I could see, but the old portion was still standing.

"The building at Montgomery and Market Streets, occupied as Southern Pacific headquarters, and the Hobart Building had lost their upper stories. The fall of the demolished portion was toward Market Street. An hour had elapsed since the first shock. Farther down Market Street I saw that the building occupied by Holbrook, Merrill & Stetson, wholesale hardware dealers, was in flames. The fire department was pumping water from the sewer, but could make no headway. To the left of this building, on Front Street, two other fires had started. I went on down Market

Street about a block and a half, when I heard an explosion. I looked back and saw that the big hardware building had been blown up. That was at 6.20.

"When I got to the ferry building I saw that the front of the tower as far as the clock had fallen in. The clock stopped at 5.15. The wall of the south end of the ferry, occupied by the Southern Pacific as a baggage room, had fallen into the bay. I went back on East Street, and as I stood looking over the ruins I counted seventy-two different fires in the city. That was before they had a chance to get together."

WOMEN IN MEN'S GARB.

In some of the provisional camps established for refugees near the foot of Van Ness Avenue and near Fort Mason it was difficult to distinguish men from women. Evidently the supply of women's clothing had been exhausted, for many women could be seen dressed in ordinary soft shirts and overalls. In this garb they were walking about their tents unconcernedly, preparing breakfast. It was no time for false modesty, and those who were able to make themselves comfortable in any sort of clothing were indeed fortunate. It was suggested to the Relief Committee, and especially to the members of the Finance Committee, that stores of khaki bloomers and blouses be purchased for the women.

Congressman Kahn arrived, having left Washington Thursday afternoon. "Never in my life have I seen such a spontaneous response to the needs of a distressed country. From every hand I was promised assistance to repair the damage that had been done to the western metropolis. Money was offered in any amount we might need, and promises were made that all the Federal buildings that had been destroyed would be rebuilt. Congressman Overstreet, of the Committee on Post-offices, asked me to telegraph him the extent of the damage to the local post-office, and said that he would incorporate in the appropriation bill now pending a sufficient sum to put it in repair. The same action will be taken in regard to the other government buildings.

"As soon as I find my family I will do what I can to aid the stricken city, because I believe that the disaster will not destroy, but only retard its progress. We should all put our shoulders to the wheel to help bring

from the ruins a city more beautiful and more prosperous than San Francisco has been in the past."

Chief of Police Dinan talked of reported clashes between police and national guardsmen, saying they had been exaggerated. "As far as the police department is concerned," said Chief Dinan, "we have endeavored to co-operate with the regulars in patroling the streets and preserving order. We have had no clash with militiamen or the citizens' patrol, but there have been numerous complaints of the overzealousness of the guardsmen by citizens, and for that reason we have deemed it advisable to request the withdrawal of all bodies of troops not acting under the direct command of General Funston.

"Policeman Alpers, detailed on duty in an automobile, was fired upon by militiamen at Hayes Street and Van Ness Avenue. He was speeding to headquarters, and was challenged by regulars several times, but no effort was made to stop him until he came up against the militia patrol at Hayes and Van Ness. They commenced to shoot before challenging the automobile party, and as the officer dashed by four shots were fired by the guardsmen.

"Captain of Police Martin was informed by militiamen in his section that there must be no lights. He told the guards that the orders were that the lights should be permitted until 10 o'clock P. M., but the guards were obdurate, and the captain put in the evening without lights. It was such little incidents as these that made the militiamen undesirable for patrol duty, and called forth a vigorous protest from the citizens."

OFFICER DEMANDED HIS CARD.

Captain Rettenhaus, of the Marine Corps, notified Chief Dinan that liquor was being sold in a saloon at Fillmore and Fuller Streets. Police Captain Duke, with a platoon of police, accompanied Captain Rettenhaus to the saloon and found the place closed. Captain Rettenhaus insisted that the stock be destroyed, and when Captain Duke explained that he had no authority to take such action Captain Rettenhaus became indignant, demanded his card and declared that General Funston would be informed that a call had been made upon the police for aid and that it had been refused.

Commanding a company of ten detective sergeants identified with the Chicago police, Lieutenant Hereford arrived on Tuesday and reported for duty to Chief of Police Dinan. They worked with the local detective sergeants and kept a special watch on Eastern thieves who were coming this way with an eye to wholesale looting.

The story had hardly spread of the killing of H. C. Tilden, a prominent relief worker, who was shot while doing missionary service in his auto, than there came the news of the slaying of Superintendent Joseph Myers, of the Children's Playgrounds. Acting under orders from the Committee of Safety, Superintendent Myers had refused to allow some armed guards to build fires on the grounds. His refusal was met with a bullet, and he died almost instantly. Superintendent Myers was a leader in charitable works.

Dr. K. A. J. MacKenzie, of Portland, Ore., second vice-president of the American Medical Association, who was in charge of the contagious diseases hospital, reported to the surgeon general of the army that 500 San Francisco physicians were destitute, their diplomas destroyed; that they were working bravely and resolutely for their fellow-men. An appeal was made to physicians to assist them.

DYNAMITE SQUAD'S WORK.

Three heroes saved what is left of San Francisco. They were the dynamite squad, who turned back the fire at Van Ness Avenue. When the burning city seemed doomed and the flames lit the sky farther and farther to the west Admiral McCalla sent a trio of his most trusted men from Mare Island with orders to check the conflagration at any cost. With them they brought a ton and a half of guncotton. Captain McBride was in charge of the squad. Chief Gunner Adamson placed the charges and the third gunner set them off.

The thunderous detonations to which the terrified city listened all that dreadful Friday night meant the salvation of many lives. A million dollars' worth of property, noble residences and worthless shacks alike, were blown to drifting dust, but that destruction broke the fire and sent the raging flames over their own charred path. The whole east side of Van Ness Avenue, from Golden Gate to Greenwich, was dynamited a block

deep, though most of the structures stood untouched by spark or cinder. Unless some second malicious miracle of nature reversed the direction of the west wind the whole populous district to the west, blocked with fleeing refugees and unilluminated except by the disastrous glare on the water front, seemed safe by 9 o'clock.

Van Ness Avenue is flat as the earth on the east side. Every pound of guncotton did its work, and though the ruins burned it was but feebly. From Golden Gate Avenue north the fire crossed the wide street in but one place. That was the Claus Spreckels house, at California Street. There the flames were writhing up the walls before the dynamiters could reach it. Yet they made their way to the foundations, carrying their explosives despite the furnace-like heat. The charge had to be placed so swiftly and the fuse lighted in such a hurry that the explosion was not quite successful from the trained viewpoint of the gunners. But though the walls still stood it was only an empty victory for the fire, as bare brick and smoking ruins were poor food for the flames.

Engines pumping brine through Fort Madison from the bay completed the little work that the guncotton had left. Mayor Mott, of Oakland, was notified that several cities of the State had been placarded with statements to the effect that skilled labor was eagerly sought in San Francisco. He said that such notices were erroneous, as there was no material in San Francisco for mechanics to work with.

TO CONTINUE LEGAL HOLIDAYS.

Governor Pardee announced that he would continue to proclaim legal holidays from day to day as long as the financial condition of the State was unsettled. The United Railroads declared that lines were safe for operations. The lights would be turned on as soon as the wires leading into houses which might prove a source of danger were cut. This work was progressing rapidly. The United Railroads tendered the use of its entire system to Mayor Schmitz for the benefit of the people during the present crisis. Free transportation was furnished the people over the lines of the company for themselves and their baggage.

There is one place within pistol shot of the city that the earthquake did not touch, that did not lose a chimney or feel a tremor—Alcatraz

Island. Despite the fact that the island is covered with brick buildings, brick forts and brick chimneys, not a brick was loosened nor a crack made. When the scientists come to write of the disturbance they will have their hands full explaining why Alcatraz did not have any physical knowledge of the event. The scene from the island was awe-inspiring. The crash of a falling city filled the ears of the aroused island, but no one understood what it was all about until a boat from Alcatraz landed at the shattered wharves in San Francisco.

CHINATOWN OBLITERATED.

The big fire obliterated Chinatown from San Francisco. Mayor Schmitz informed Chief of Police Dinan that all of the Chinese in the city would be collected and placed in and near Fontanas warehouses near Fort Mason, and that the new Chinatown would be located at Hunter's Point, on the southern extremity of the county on the bay shore. It is several miles distant from the old Chinatown.

One of the gruesome scenes that followed the fire was that witnessed on Telegraph and Russian Hills and along the entire north beach front of the city, when scores of half-starved dogs were found eating human bodies. The animals were discovered gnawing and tearing at the corpses half-buried in the ruins. Men who had been sent into the ruins of homes to look for what little property might have escaped the flames came upon this sickening condition and immediately reported it to the naval officers in command of the water front military districts. In response to their appeal that something be done, bluejackets were detailed to cover the sections designated and kill all dogs found in those vicinities. All morning rifle reports could be heard on the hillside and along the beach as the dogs were killed.

It was a ragged, unkempt and hungry crowd of refugees which arrived at Omaha from San Francisco on the first of the free trains on the Union Pacific Railroad. Other such trains were following closely. Among the passengers in the entire trainload there probably was not $5. Weary and worn they had climbed aboard the train at Oakland in a condition bordering on collapse. Added to this was three days' travel in ordinary day coaches, every seat filled.

Mrs. Wilson Evans, of Reading, Pa., said: "I am all that is left of a family of five. My husband and three children were killed, and their bodies buried. We were living in the city. I saved an old wrapper, nothing more. I only want to get away from that terrible place."

Henry Howe, a seventy-year-old man from St. Paul, was in the Hotel Langdon. He said: "I woke when the ceiling fell on me and pinned me to the bed. After several hours I managed to get loose, wrapped a blanket around me and crawled away. Sometimes crawling, sometimes walking, I managed to reach a camp with nothing but my blanket. Somebody gave me the old clothes I am wearing."

L. A. Dickerson, of Indianapolis, was in a hospital sick with fever.

"I was twenty-four hours making my way to the ferry because of my feeble condition," he said. "I had only a night shirt. The steward of the train lent me a pair of trousers and the porter gave me this coat. I have no hat and nothing else."

"I was in the Golden West Hotel," said Willis Hammond, of Anderson, Ind. "I managed to reach the street and was knocked senseless by something. When I recovered I was lying in Mechanics' Pavilion along with a long row of dead men. I had been hauled there in a wagonful of dead. When it was found that I was practically unhurt a pair of trousers taken from a dead man was given to me. It is all I have."

MAN KILLED ON WEDDING TRIP.

"My husband and I were at a rooming house south of Market Street," said Mrs. William Stone, of Emmettsburg, Ia. "The house collapsed. He was killed at my side. His body was taken away by the authorities. I don't know where. I secured an old dress skirt and at Ogden a woman took off her shoes and gave them to me. We were on our wedding trip."

Mrs. James Taylor, an old woman, who had a bloody cloth bound about her head, said: "I am a widow and lived with my son and his family. The house fell. The relief workers pulled me out after several hours. They said the others were dead. I have friends in eastern Ohio and am going there."

Similar stories were told by all. There was little excitement. Occasionally some woman broke out into hysterical weeping for a moment, but

in the main all they seemed to want was to be let alone with their thoughts, and all wanted to get as far away from San Francisco as possible.

At Omaha a large booth was erected in the street near the Union Depot and in this the refugees were being fed. The trains were expected to continue for two or three weeks at the rate of two or three a day.

The first mails from San Francisco, after the catastrophe, arrived on Tuesday. Volumes of letters, unstamped and many of them without envelopes, were in the sacks. They had been sent by sufferers in San Francisco in the desperate chance that they would reach relatives and friends in other places. The Government was delivering all such matter received and was collecting no due stamps thereon. Some letters were written on cards, others on wrapping paper and even pieces of paper sacks were used. The general trend was, "We are alive, but have lost everything."

GRAPHIC ACCOUNT OF DISASTER.

The following letter was from a prominent advertising agent of San Francisco. It was written hastily the day after the earthquake and fire, and is a graphic first-hand account of the disaster:

"San Francisco is a heap of smouldering ruins. Since the first shock there have been several shocks, lighter, of course, yet each adding to the terror of the people. At 5.13 yesterday morning I was awakened by the rocking of the house.

"I sat up in bed, saw the bureau dancing about the room, and said: 'This must be a real earthquake.' Then I looked for my glasses and found them safe on the floor, dressed and climbed over the bricks, for the chimney had fallen through the roof, striking about twenty inches from the head of the bed. Narrow squeak, that!

"I go downstairs to street, which is filled with frightened men and women, some moaning and shrieking, others laughing hysterically. I go up to Mission Street, where a great fire is in progress.

"The Valencia Hotel, near Nineteenth and Valencia Streets, has collapsed, the ground opening and the hotel dropping into the crevice. Four stories, containing eighty odd souls. I watch them removing eight dead

bodies. Here is a dry-eyed little woman who wants me to find out if her brother was saved. I ask where he slept, and learn that he was on the first floor. Poor fellow! He i crushed to death. Another blood-stained, tearless woman, assures me that her husband is in the hospital with a broken shoulder. I saw his body at the corner barroom not five minutes ago, but I don't tell her so.

"So I go downtown. Streams of terror-stricken refugees, thousands of them, laden with all manner of goods, pouring up Market Street, aiming for the upper part of the city. San Francisco must be wholly rebuilt. All the business section and the manufacturing district is burned to the ground. In the residential districts the buildings are so twisted that they must be torn down and rebuilt.

CORPSES FEARFULLY MANGLED.

"Twenty-six adults and two children lay stretched dead on the grass at Washington Square, all fearfully mangled, for most of them were killed in bed by falling walls. Chief of the Fire Department Sullivan was so killed. One corpse is laid on the grass, and the soldier lays his foot, wrenched off midway between the ankle and the knee, beside the corpse. The soldiers' hands and uniforms are blood-soaked. One Chinaman has the top of his head off. The buildings across the street are being dynamited by the soldiers, and they go up in a shower of sparks.

"See the people flee! Here is a woman, a parrot in one hand, a milliner's creation in the other, followed by her husband, with a tin teapot and a woman's silk dress. He would do better to carry a blanket. He will need it.

"Battery Street—here and there is a front wall standing, ready to topple over on the mass of debris. I climb over the bricks in the middle of the street. My God! How hot it is here! The bricks beneath scorch my shoes. And there falls a front wall just back where I was a few seconds ago. Something must have struck my left shoulder, for it is sore and numb. A brick from the wall, no doubt. Finally I reach Market Street, and turn down towards the Ferry building, running between two seething walls of flame, on either side, my face and hands scorched, my feet hot. Safes are strewn all around the street.

"I look at one. Within the ruins are hundreds of safes, lying on the burning mass. Electric wires impede my progress, and I stumble and fall upon the sharp bricks many times. From Battery to within half a block of the Ferry not a soul do I see. No soldier, no fireman, no policeman will enter that furnace. But I must get across the bay with despatches for the East. I cross the ferry and bulldoze the operator to forward them 'collect,' for I have not two dollars in change with me. My money is underneath the mass of bricks at the house.

"Never mind. I am alive, and 'in luck' to be here.

"No trains going through Oakland to San Francisco. They stop in Oakland by orders of the military, to keep strangers out of the city. So I hoof it three miles over the tracks to the Oakland mole, and am one of twenty-odd passengers to the city. The sight of the burning city across the bay is a grand one. The wildest rumors are current.

"Arrived at San Francisco, I make my way west along the water front, pass through the Latin Quarter, which has been lightly visited by the 'quake,' pass through Chinatown, where the 'chinks' are in terrible confusion; climb the hill, and find the beautiful new Fairmount Hotel is intact, the finest, most costly building in the city. I look down on the burning city below, with the business blocks rising high in the air, dynamited by the soldiers in hopes to prevent the spreading of the flames.

GRAND, TERRIBLE SIGHT.

"It is a grandly terrible sight; worse, I think than war, for here there is a nameless dread of something which may happen any moment. Poor, old, aged women are seated on their few belongings, with terror in their eyes and mutely questioning gaze. One 70-year-old woman asks in a voice scarcely above a whisper for whiskey, and I had bought a bottle of Scotch whiskey in Oakland to bring home. The old lady clutches the bottle eagerly, and I pass on, leaving it with her. Well, the folks at the house must get some whiskey, if they want it. I have 'invested' mine.

"Food is at famine prices. Oranges, two for 25 cents. A San Mateo County milkman drives along. He wants $5 per can for his milk. A member of the crowd offers him a dollar per can. He refuses, and in a minute the crowd empties his wagon, carrying off the cans, and he gets

not a penny. Served him right. Teams charge $8, $10 or $12 to carry a trunk four blocks. The falling ashes from the conflagration cover the sidewalks. Thieves have been busy throughout the night, and several have been shot dead by the military. San Francisco has received a terrible blow, one which it will not recover from in ten years. To mail this I must walk four miles and then cross the bay."

STATEMENT BY WELL-KNOWN AUTHORITY.

The following is a statement by the well-known authority, Prof. Edgar L. Larkin:

Seismic ragings have been familiar since remote historic times. And the torn strata of the ancient earth bear mute evidence that they have tossed, warped and wrenched the ever-thickening shell, since the external envelope began.

The earth was once a prolate sphereoid of white hot liquid. It rotated on its axis and this motion caused a bulging out of the liquid all round the equator. And at the time the cooling allowed a crust or layer of rock to solidify, the ring of melted stuff was thirteen miles deep, at least the solid band is that deep now.

But the liquid inside the thin shell cooled, contracted, shrunk and subsided and the rocky covering settled and cracked into millions of pieces and fell into the seething mass below, exactly as would cakes of ice to a drained pond. And the process was repeated over and over again during an uncounted number of millions of years. Great tides, caused by the moon, after it had been formed by matter separated from the earth, moved around the globe, and this tide cracked the shell into numberless cakes until it became too rigid to break it further.

After the earth became firm, and when water appeared, deposits on the ocean floor began. Countless ages expired in the deposition of strata. Quadrillions of aquatic animals died and contributed skeletons to the forming layers on the bottom of the seas. Layer after layer appeared, all resting on primordial azoic rocks, igneous, without trace of life.

But the interior kept on losing heat by convection and radiation partially, but far more escaped into space through torn and ragged throats, incipient volcanoes.

Contractions continued with increased bendings, cracking and rending of the now thickened "egg shell." Earthquakes rapidly increased in number and severity. The thicker the crust the greater the intensity of ruptures. Cooling went on and then an entirely new giant appeared—chemism. It could not act until the temperature was low enough. Thus chemism does not now act in the sun; that is, compounds are not forming, elements are at such terrific heat that they cannot unite.

But when chemical elements formed in the earth's interior, in a cooler place, and then separated in a hotter, immense volumes of gas were liberated with pressures beyond comparison. These gases made vast numbers of volcanoes and numerous earthquakes. And when water reached the white hot mass, real and typical earthquakes and volcanoes appeared in colossal power and racked the primeval world. The mass of the earth's interior is now white hot, for the craters of Vesuvius and Kilauea, when boiling, just before an outburst, are blinding white.

ACTION OF VOLCANOES.

I have watched every detail of craters on the moon in the great telescope in the Lowe Observatory. Some are low, mere gas-escapes, and others rise to more than two miles in altitude. The rims, cones and edges can be studied at leisure. Rocks, weighing many tons, have been shot up from terrestrial cones to great heights. These elevations have been measured, and from that the pressure required has been computed, and forces in some volcanoes were several thousands of pounds per square inch. Cones fall into the caverns formed by the outcast lava at times, and there is a beautiful example on the moon.

The question now arises, did man appear before the earth was ready?

What awful energy raged throughout cosmic space when suns and planets were condensing, and what lightnings played, what roaring of thunders, explosions, boilings, kneadings and mixing, and what eons were passed in the process. Then appalling turmoil, turbulence and upheaval died away. Things grew still more quiet; forces died away, hush came on and silence almost.

Nature was preparing a quiet, still place for the home of man. Finally quietude almost complete came on, scarcely a breath, and then man came.

He is delicate, indeed, a mere creature of temperature. A zephyr can wipe him out of existence.

The marvel is that nature ever became quiet and still enough for him to step upon the stupendous scene. If the sun increases its heat a few degrees, or loses a few, all humanity will expire, and the change in the sun would not be great. Positively, a hush is now on the earth or man would vanish. Primitive men were sorely disturbed by internal earth convulsions. Modern man has ever been harassed.

And now the appalling disaster at San Francisco will rank with any calamity that has troubled man. Not only the metropolis, but the lovely cities round about, the great Stanford University, that marvel of beauty and loveliness—vanished in ruins. Stop one moment and think about the word ruins.

I do not like to write about the dead and dying. A shudder is over the nation, and pity. It is still the opinion of the writer that Los Angeles is not strictly in an earthquake region. The land was placed here by water and not by fire. The region is not volcanic. Unnecessary fear should not be entertained. True, I am writing this in a high building, that was shaken by three faint tremors a few minutes ago, but I have experienced worse up in the observatory.

We recall some poems which have a pertinent meaning in connection with the great catastrophe:

SAN FRANCISCO.

Serene, indifferent to Fate,
Thou sittest at the Western Gate;

Upon thy heights so lately won
Still slant the banners of the sun;

Thou seest the white seas strike their tents,
O Warder of two Continents!

And scornful of the peace that flies
Thy angry winds and sullen skies,

Thou drawest all things, small or great,
To thee, beside the Western Gate.

* * * * * * *

O lion's whelp, that hidest fast
In jungle growth of spire and mast,

I know thy cunning and thy greed,
Thy hard, high lust and wilful deed,

And all thy glory loves to tell
Of specious gifts material.

Drop down, O fleecy Fog, and hide
Her skeptic sneer, and all her pride!

Wrap her, O Fog, in gown and hood
Of her Franciscan Brotherhood.

Hide me her faults, her sin and blame;
With thy gray mantle cloak her shame!

So shall she, cowled, sit and pray
Till morning bears her sins away.

Then rise, O fleecy Fog, and raise
The glory of her coming days;

Be as the cloud that flecks the seas
Above her smoky argosies.

When forms familiar shall give place
To stranger speech and newer face;

When all her throes and anxious fears
Lie hushed in the repose of years;

When Art shall raise and Culture lift
The sensual joys and meaner thrift,

And all fulfilled the vision, we
Who watch and wait shall never see—

Who, in the morning of her race,
Toiled fair or meanly in our place—

But, yielding to the common lot,
Lie unrecorded and forgot.

—From the poems of BRET HARTE.

OUR LADY OF THE GOLDEN GATE.

"Serene, indifferent to Fate," she stands—
Bare breasted, girt with sand, and sun caressed;
With power undiminished, strength unguessed
Till now, though gaping pits and rav'ning brands
Have scorched her tunic and have scarred her hands—
As who should say: "My race is not yet run.
My triumph comes when my new days are won.
Bring bay and laurel! These are my demands."

So speaks Our Lady of the Golden Gate,
And we who hear the marvel of her voice
Smile back and toss her laurel, rose and bay;
Because serene indifference to Fate
Breeds strength to conquer, power to gain a choice,
That thrusts our night of sorrow into day.

—J. C. B. ANDREWS.

THE STRICKEN CITY.

Crushed by the earthquake's heavy car,
Seared by the flames' destructive breath,
Thy friends and lovers we from far
Hasten to rescue thee from death.

Hope, stricken city by the sea!
O'er mountain height and dreary waste,
The weary miles to succor thee,
With helpful sympathy we haste.

Thy woes are ours. Did we appeal
In need to thee, as now thy call,
The bonds of brothers, strong as steel,
Would gladly offer us thine all.

Take heart! The future hath in store
A grandeur that shall dim the past,
And, Phoenix like, shall rise once more
A city nobler than the last.

—WILLIAM C. WHEELER.

A survivor who reached Philadelphia told his story of two days and nights of horror in San Francisco:

"At this moment," he said, "I don't know how exactly to describe my sensations. I am as one who has been called back from the gates of the grave. It all seems so strange to be back here in this quiet old city. It was about 6 o'clock on Tuesday night when we entered the St. Francis Hotel in San Francisco and took a room on the eleventh floor.

"I had been asleep a little more than four hours, when I was awakened by a crash as of thunder, to find myself in the middle of the floor. The room was shaking to and fro, or rather rolling from side to side, like the movement of a pendulum, gradually slackening as the pendulum does when the clock stops. All was still. I heard no sound outside, and at first I thought that the shaking might be part of my disordered fancy.

"Nothing in the room was disturbed. As my senses slowly returned, I began to realize that it was an earthquake. Then Mr. Heyl, my traveling companion, rushed into my room and an instant later ran out. Somehow, after the first shock we did not seem in the least disturbed. I put on my clothes, packed my gripsack and wound up my watch just as usual. Then I walked over to the window and looked out. What I saw sent me staggering against the wall with amazement and fright, for before me houses

were crumbling. Down in the street, in the light of the dawn, a thousand faces, with a white terror on them that I shall never forget, were, it seemed, looking up into mine. I saw the crowd move onward with a swift swirling rush, like a picture impossibly painted on a running river. I ran out into the corridor. Mr. Heyl was nowhere in sight.

"The thought came to me of the women who were downstairs. For, in telling you this story, I have almost forgotten the women. I made for the second floor, where I knew the women were. I noticed as I walked down the broken stairs that, while the rooms on the high floors had escaped damage, the lower part of the hotel was wrecked.

"The rooms of the Aumonts were all broken up and empty, and so I went into the square and came upon Mr. Gill and Mr. Heyl with the ladies. We saw the fires breaking out in half a dozen places, and we decided to move on. The rest of the crowd, or so it seemed to us, did the same, and we were carried northward with the tide, so we were plodding onward, the women growing wearier and wearier at every step, when we came upon a young, sweet-looking woman, who was crying. She said she was looking for an undertaker. Her little brother lay dead at home. He had been crushed by a falling chimney.

TURNED FROM HER OWN GRIEF.

"Then she turned to us, saying, 'Oh, you poor people, your need is as great or greater than mine, so come to our house and we will take care of you until the danger is past.' She was a Miss McEwen. Her mother was a widow, with three unmarried daughters, and they lived at the foot of Nob Hill. They forgot their trouble, the presence of death in their house. Their thought was only for us. And our women cried, kissed and cried over the little boy, lying as he had been stricken in his sleep.

"For a whole day we were in that house, sharing what little they had. Mr. Gill and myself had the forethought to go into the street and gather up all the eatables we could buy at famine prices. The order had gone out that no fires were to be lighted, and all that we could get was such things as biscuits, cheese, pickles and ginger ale.

"All my own thought at this time was of my wife. I knew that the story of the earthquake was in Philadelphia. Twice I fought my way

through the streets to the Western Union office, and each time was told that the wires were down. All through that Wednesday the fire was gradually creeping nearer and nearer our part of the city, and the flames were already on Nob Hill when we started for the Presidio. That was our objective point, the only place that I or any one else thought of at that moment.

"We had gone about half way through the city when Mr. Gill suggested that we make for the ferry. And there it was that we had to say good-by to our good friends the McEwens. In a grave by that deserted house they had left the child. They were seeking refuge at the Presidio. The last we saw of them they were looking after us, their eyes red with crying.

AT THE FERRY.

"A great, black, heavy mist was in the air. As we walked along the throng seemed to grow bigger and bigger with every step. From time to time soldiers would stop us, but they were always as kind as they could be and helped us along. As we went we could hear the crash of buildings and the reports of the dynamite. Women, from first to last, were wonderfully cool and composed. When we reached the Meggs Ferry it seemed as though all the world had come together, blacks,, whites, Celestials, children of the Orient, children of the Occident, heathen and Christian, laborer and aristocrat, beggar and millionaire, all brought together as they will be on the last day. There came up to us a blackened, bedraggled man pushing a cart laden high with papers and valuables. His wife and daughters trailed behind with bundles on their heads. Everybody in that crowd recognized him as one of San Francisco's biggest millionaires.

"We waited two hours in that crowd before the ferryboat came up. I thought that no ferryboat ever built could hold that crowd, until I saw the boat which we took. That was as large as some ocean-going steamships. At Oakland we quickly got a train."

Another refugee told of his experience: "What I have to tell can be told in a very few words," he said. "I was one of a party headed by George Kessler, of New York. We went West in March; the trip was purely a business one and on the way Mr. Lewis, one of the party died.

But to come down to the earthquake: I was in the St. Francis with the rest and was tumbled out on the floor like the rest. I knew what had happened; decided that lightning never struck twice in the same place and took my time dressing. I was on the second floor and I really think that I was the first man out of the hotel. All the world seemed to be collected in Union Square. There was just the sort of rush that you'd expect to find at such a time. Yet every one was quiet. The earthquake had scared the wits out of them.

"George Kessler came along presently and said, 'Look here, boys, we've all got to keep together.' We saw Pol Plancon in a night shirt, a cutaway coat and a silk hat. He was carrying a valise. Finally I went back to my room, and soon after we got the second shock. Well, we made tracks out again just as quick as we could. A Frenchman had gone to the garage and got George's automobile ready. That auto saved our lives. The whole party got together and we spun out to the Casino, which is on the other side of Golden Gate Park, far away from the Presidio. There we remained two nights, having a pretty good time, all things considered, though we had to pay $50 for a wagon to fetch some more of our goods from the St. Francis. From that point, when it began to get crowded, we went on to San Jose, which was in an awful condition, and then we made our way to Oakland. That auto was a godsend if ever you saw one. George Kessler gave $3500 for it two days before the earthquake. After the earthquake he would not have taken $35,000."

AS A WOMAN SAW IT.

Mrs. W. E. Aumont, one of the party aided by Mr. Kessler, told about the earthquake: "The room rolled like a ship at sea," she said. "The lower part of the hotel suffered the most, and our room looked as though a cyclone had gone through it.

"The first instinct of a woman in danger is to rush for the window. I did this, and I saw a great throng flocking into the square from all directions. We all caught up what clothing we had and got out into the square. Then we heard that fire was beginning to eat its way through the city, and at the suggestion of Mr. Kessler we made for higher ground. On every hand we saw fires. The air was full of thick smoke that choked

and blinded us, while the way was blocked by falling buildings. Then, in front of the Fairmount Hotel, there came to us a young lady, Miss Jane McEwen. She saw perhaps that I was exhausted, for she caught my arm, saying: 'Come to my house. You must come, and you will be safe with us.' Her mother and sisters were in that house. How in this world can I or those dear to me ever forget how those poor women took us in and sheltered us all for that day and night until the cruel, merciless fire came up and ate their home? I can never forget our parting."

A startling reminder of the horror of a week before came in the afternoon of April 25th, in the shape of another earthquake shock, which shook the ruined city from end to end and sent terror to the hearts of the people, whose nerves were suffering from an experience which at times touched the limit of human endurance. The new shock came at a quarter past three and lasted nearly a minute. A number of walls left standing in the burned district were shaken down and some damage was done to frail structures. The shock was also felt in Oakland and Berkeley, but in these places it was very slight and of brief duration.

SUFFERED FROM COLD.

While there was food in plenty for those left destitute by the earthquake and fire, which drove 300,000 from home, the need of proper shelter for the refugees in the parks was felt Tuesday night, when the wind blew cold and raw across the camp grounds. Thinly clad women and children huddled close or walked about all night trying to keep warm. Even those in tents or shacks suffered, as the order against building fires was strictly enforced.

Except for the need of blankets and tents conditions were growing brighter. The work of the engineers who were dealing with the sanitary questions was effective and the health of the city was remarkably good under the circumstances.

The exodus from this city continued, stimulated by the shock of the afternoon. All day a constant stream of men, women and children, afoot and on every conceivable vehicle, wended their way down Market and Mission Streets toward the ferries. A little bundle on a stick carried over the shoulders represented all the worldly possessions of some; others held

grips and baskets, and a great many had saved trunks and furniture. It was estimated that 60,000 persons were furnished with free transportation yesterday to the different parts of the State by the Santa Fe and Southern Pacific Railways.

Between 6 A. M. Wednesday, April 18th, and the following Sunday night, the Southern Pacific ran 129 trains with over 900 cars over the main line and local and eastern points, carrying refugees free. During the same time 610 suburban trains were run from the Oakland pier with 4880 cars. During the same period about fifty trains with 500 cars were run from points between Third and Townsend Streets and Oceanview to the south. The number of people carried from San Francisco exceeded 225,000. The value of the transportation issued free by the Southern Pacific at San Francisco, Oakland, San Jose, Santa Rosa, Sacramento and Vallejo had, at a rough estimate, exceeded $400,000.

PROVISIONS COMING IN.

Many carloads of provisions and supplies were being received daily. Five cars were received from Southern California, among other things 3000 blankets, which were immediately distributed at the transport docks by the marines. The blankets came at an opportune time, but were insignificant in number to what are actually required.

As a result of Mayor Schmitz's sharp letter to General Koster, in which the Mayor called the General's attention to the fact that the city was not under martial law and that the drastic measures and arbitrary actions of some of his men were illegal, there was little trouble in the district over which the militia held sway. A marine reported finding a light burning in a house on lower Fillmore Street after 10 o'clock at night and the military sentry on the post shot through the window. A looter who, it was said, broke into several places on Vallejo Street was reported to have been shot by a marine sentry at Vallejo and East Streets.

Several bullets fired from the water front struck a Red Cross launch in which Dr. Diggins, of the Emergency Hospital service, was going from the Potrero district to the Presidio. The shooting was done while the launch was off the ferry depot. None of the occupants was injured. The fact that two companies of the Fourteenth United States Infantry, from

Vancouver, went to Oakland on Tuesday to do guard duty in that city, indicated that the militia would be recalled.

"All's well!" were the words that went down the line at police headquarters when the officers had finished their long night vigil through the burned districts and reported off duty to their captains to-day.

"From the reports of officers filed," said Chief of Police Dinan, "there is every indication that San Francisco has settled down to almost a normal condition. Our officers are everywhere as usual, but petty thievery has kept the upper office men of the department busy.

"The one perplexing problem that we now have to contend with is the prevention of an unequal distribution of food. Those of the worst element of the city, we find, are living better than they ever did in their lives, while the unfortunates who have never been accustomed to ask for aid are actually suffering. We are doing all in our power to relieve this condition, and hope, in a few days, to get rid of those who are taking everything in sight."

TO GUARD AGAINST FRAUD

Beginning on Thursday kitchens and mess rooms were established, where meals were supplied to all who applied, and the distribution of food to be carried away was discontinued.

In the distribution of clothing precautions against fraud were taken by squads detailed to visit each tent and tabulate the wants. Orders were given out entitling the holders to the needed clothing, bedding or other stores.

At one of the parks Wednesday morning a handsomely dressed woman with two children at her skirts stood in a line of many hundreds where supplies were being given out. She took some uncooked bacon, and as she reached for it jewels sparkled on her fingers. One of the tots took a can of condensed milk, the other a bag of cakes.

"I have money," she said, "if I could get it and use it. I have property, if I could realize on it. I have friends, if I could get to them. Meantime I am going to cook this piece of bacon on bricks and be happy." She was only one of thousands like her.

In a walk through the city this note of cheerfulness of the people in

the face of an almost incredible week of horror was to a correspondent the mitigating element to the awfulness of disaster. In the streets of the residential district in the western addition, which the fire did not reach, women of the houses were cooking meals on the pavement. In most cases they had moved out the family ranges, and were preparing the food which they secured from the Relief Committee.

FORGOT MISERY IN SONG.

At night out on Broderick Street, near the Panhandle, a piano sounded. It was nigh 10 o'clock and the stars were shining after the rain. Fires gleamed up and down through the shrubbery and the refugees sat huddled together about the flames, with their blankets about their heads, Apache-like, in an effort to dry out after the wetting of the afternoon. The piano, dripping with moisture, stood on the curb, near the front of a cottage, which had been wrecked by the earthquake. A youth with a shock of red hair sat on a cracker box and pecked at the ivories. "Home Ain't Nothing Like This" was thrummed from the rusting wires with true vaudeville dash and syncopation. "Bill Bailey," "Good Old Summer Time," "Dixie" and "In Toyland" followed. Three young men with handkerchiefs wrapped about their throats in lieu of collars stood near the pianist and lifted up their voices in melody. The harmony was execrable, the time without excuse, but the songs rang through the trees of the Panhandle and the crowds, forgetting their misery for a time, joined the strange chorus.

They tell a tale of comedy—how on the morning of the fire a richly dressed woman who lived in one of the aristocratic Sutter Street apartments came hurrying down the street, faultlessly gowned as to silks and sables, save that one dainty foot was shod with a high-heeled French slipper and the other was incased in a laborer's brogan. They say that as she walked the beauty careened to leeward like a bark-rigged ship before a typhoon.

An hour spent behind the counter of the food supply depot in the park tennis court yielded rich reward to the seeker after the outlandish. The tennis court was piled high with the plunder of several grocery stores and the cargoes of many relief cars. A square cut in the wire screen permitted of the insertion of a counter, behind which stand members of the

militia acting as food dispensers. Before the improvised window passed the line of refugees, a line which stretched back fully 300 yards to Speedway track.

"I want a can of condensed cream, so I can feed my baby and my dog," says a large, florid-faced woman in a gaudy kimono, "and I don't care for crackers, but you can throw in some potted chicken if you have it."

"What's in the bottles over there?" queries the next applicant. "Tomato ketchup? Well, of all the luck! Say, young man, just give me three."

A little gray-haired woman in an Indian shawl peers timorously through the window. "Just a little of anything you may have handy, please," she whispered, and she cast a careful eye about to see if any of her neighbors recognized her standing there in the "bread line" where food was given away, not sold. Her pride pinched almost as hard as her hunger, but the keener spur was the stronger.

WANTED SOME OLIVES.

Even the weary National Guardsmen who dispensed food from this wicket the whole day through found odd cases of absolute perversity in them at times. Said a seargeant of the signal corps: "This morning a lady with diamonds in her ears asked if we could send to the Presidio camp for some green olives, and another woman said if we could not give her any better food she would not eat our stuff. And she made good on her threat all right. She went away without anything."

The "bread line" was not the only rich field for comedy. Where the tent dwellers did the family cooking there laughter in "cap and bells" sat enthroned. One young householder who had known until recently the dignity of a stool in a railroad office and $75 a month, knelt gingerly on two pieces of paper spread upon the damp ground and blew into his brick furnace with the wrath of Boreas, with the result that his fountain pen dropped out of his waistcoat pocket into the coals, exploded and tattooed his countenace with beautiful designs in violet.

Mrs. Rudolph Spreckels, wife of the well-known financier, presented her husband with an heir on the lawn in front of their mansion on Friday when the family were awaiting the coming of the dynamite squad to blow

up their magnificent residence. An Irish woman who had been called in to play the part of midwife at a birth on Saturday, made a pertinent comment after the wee one's eyes were opened to the walls of its tent home.

"God send earthquakes and babies," she said, "but He might, in His mercy, cut out sending them both together."

The following telegram was received to-day from President Roosevelt by James D. Phelan, chairman of the Finance Committee:

"The Finance Committee can use the United States Mint at San Francisco as a depository for relief funds until the sub-treasury opens, and thereafter can use the sub-treasury until the banks open. They could withdraw funds from the depositories in sums not less than $1000, as the Government offices in San Francisco are not equipped to do banking business. Please consult as to details of arrangements the superintendent of the mint at San Francisco. Secretary Shaw will immediately wire suitable instructions to the superintendent of the mint and the assistant treasurer. Authority is specially given to the Secretary of War to disburse the congressional appropriation, amounting altogether to $2,500,000."

THE FIRE DEPARTMENT LOSSES.

The losses of the San Francisco Fire Department during the earthquake and fire were made known. As far as known three firemen were killed and one injured. The apparatus of the department, while damaged, was still intact. Nineteen companies, however, were put out of commission, and many of them were disbanded. Excluding the dead and injured, there were about 100 members of the department missing. It was believed, however, that these men had been separated from their companies and would rejoin them soon.

The Commissioners were equipping the department for the protection of the unburned portion of the city. The alarm system was wrecked. In the meantime men were detailed to patrol near the firehouses and, at the first indication of fire the engines were turned out. The department was still handicapped for water.

An idea of the task which confronted the Food Committee may be gained from the fact that throughout the city rations for 349,440 persons were distributed on Tuesday. This was an average estimate based on re-

ports from a few of the food depots. At one point provisions were given out of 672 persons an hour for ten hours. All flour that was received in sacks was exchanged at the bakeries pound for pound for bread. Almost all the bakeries in the unburned regions opened and were selling bread at 5 cents a loaf.

There was no danger of a meat famine. Representatives of the Western Meat Company in South San Francisco reported to the Relief Committee that there were 1500 cattle, 3000 sheep and 500 hogs on hand. More than 200 cattle were killed and dressed daily and sheep and hogs were put under the knife as fast as they arrived. The full quota of employees was at work.

The Southern Pacific ordered all cattle cars to be rushed to San Francisco with precedence over passenger trains. Some stories of suffering from exposure, ignorance and helplessness were coming to the Relief Committee. Of the great refuge camps that in the Presidio, which was under Government control, seemed most thoroughly systematized and that in Golden Gate Park most disorganized, although it was rapidly assuming a habitable basis.

FRUIT DISTRIBUTED.

Many tons of fresh fruit were distributed Tuesday and Wednesday. Bunches of bananas and boxes of oranges were given unsparingly to the people who flocked from the tents along the beach and about Fort Mason. The oranges had been shipped to San Francisco for commission merchants before the earthquake. They had not been unloaded from the warehouses and cars, and escaped destruction to a large degree.

The surgeon in charge of the general hospital at the Presidio said that his force was perfectly organized, and that seventy-five members of the army nurse corps came from Chicago. They were divided among the Presidio and the emergency hospitals of the city.

An official list of the condition of the school buildings throughout the city showed that twenty-nine buildings were utterly destroyed and that forty-four were at least partly spared. As many of the latter were so damaged that they would have to be either pulled down or thoroughly

repaired, it was probable that the resumption of the short term would be made in tents erected in the parks.

With unwavering faith in an image, twenty Chinese gathered in a desolate spot in the ruins of Chinatown one afternoon and worshipped in full compliance with the rites of their religion. In the ashes of their temple they knelt and silently offered prayers. Prostrate in the smouldering wreckage before them was the charred trunk of an image that once held the altar in the temple of Shai Tai. The fumes of fresh incense and sacred punks sailed skyward. All the dainties obtainable under the circumstances were spread in propitiatory offering to the devil that no offense to that personage might bring a recurrence of the disaster.

GENERAL GREELY'S MESSAGE.

General Greely sent the following message to the Acting Secretary of War:

"Three hundred thousand people are homeless and the entire business facilities of a city of half a million have been destroyed, except those of one street of minor importance; accommodations for most urgent financial and other indispensable business institutions are being obtained only with the greatest difficulty. The entire body of those men are naturally devoting their energies to restoring their own affairs, and even those who have applied themselves devotedly to relief and rescue work the past week are gradually withdrawing therefrom, stating correctly that domestic and business affairs demand their entire attention.

"The Mayor and the police are so fully occupied operating without ordinary accommodations that even the ordinary current duties, such as pertain to the Coroner's office and vital statistics, are largely neglected for lack of force and office accommodations. Under such conditions a registration bureau is impossible. The newspapers have taken up the matter as far as possible with their own limited accommodation, and it is understood that a kind of registration bureau has been opened in Oakland. Can only suggest that interested parties telegraph the *Examiner,* the *Call* and *Chronicle,* who at present are best informed as to the location of prominent individuals.

"To appreciate this situation it is to be borne in mind that San Francisco covers twenty-five square miles, and that all street car lines and usual methods of local transportation are still unavailable and inoperative.

"There is no telegraph system within the city except that constructed by the signal corps, nor does any telephone service exist beyond the military system connecting these headquarters with the mint, post-office, various district headquarters and other points of great public importance.

"Even the present military systems are being continually broken by parties engaged in repair and rescue operations. Under these conditions, no part of the city can be reached save by a messenger on foot, which entails hours, or by automobiles, of which there are few.

"I have gone fully into the situation to prevent misapprehension and to enable the War Department to disclose the situation to the public. It should be added that the names of dead have already been furnished the Department, and if desired the names of every injured person in hospital will be similarly transmitted. To relieve public apprehension, it should be clearly understood that beyond isolated cases already reported there are no deaths or serious injuries of guests of any well-known hotel in San Francisco.

NO DEMAND FOR NURSES OR DOCTORS.

"It should be also understood that there is no demand for nurses or doctors. The medical, civil and military will be able to handle the entire situation unless unexpectedly adverse conditions arise. The hospital corps force sent here will be utilized more for sanitary purposes and preventive measures than for the cure of any great body of sick, of which none exist."

A wave of business activity was shown and preparations for resumption in all sorts of trade were in evidence everywhere. Many more retail merchants opened their stores, some at the old stands, others in temporary quarters, but each one with a cheerful determination which characterized the attitude of all who were planning the city's restoration.

There was especial activity among banking interests. Over in Oakland the majority of the banks reopened and announced themselves ready for business. There was no run and no excitement at any of these institu-

tions. The remarkable feature of the day's business at some of the banks was that more money was deposited than was withdrawn, indicating a feeling of confidence which was cheering to business interests.

Among the local institutions plans were formed for a speedy resumption. "Bankers' Row" was organized on La Guna Street, west of Lafayette Square. The Crocker-Woolworth National Bank, the Central Trust Company and the Mercantile Trust Company placed their cotton banners on residences overlooking the tented camps of the refugees in the square. The clearing house, representing the commercial banks, held their usual meeting. While the details were not completed, it was arranged to pay depositors not exceeding $500 on their accounts. Each of the banks had large sums transferred to its credit by correspondents in London, Paris and New York. These transfers were made to the Mint, on Fifth Street, and the money was available at that point.

WAITING FOR VAULTS TO COOL.

The bankers were waiting for the cooling of their vaults so that they might open them and reach their books and papers. The Executive Committee of the savings banks also met. Much satisfaction was expressed at the fact that all the vaults of these banks had been found to be in excellent condition.

The embargo against travel into the city was raised on April 26th, and as a result thousands who had fled the town during the disaster returned to visit the scene of their former homes or business places. An official estimate was that San Francisco had lost, temporarily at least, about 200,000 of her population. The estimate was probably very much too small. The San Franciscans who were in deadly earnest contended that a large percentage of those who left would return soon, and that they did not want the others. The tide of exodus slackened considerably. A prominent city officer said:

"There will be more work in San Francisco this year than there are people in all California to do it."

Parts of the city, on the outskirts of the ruins and in the unburned section, resembled a boom town on the frontier. There was talk of real estate deals, temporary offices of all kinds were erected and improvised,

and plans were made for active business operations at once. The Stars and Stripes were hoisted over one tall building that stood surrounded by ruins.

One of the most encouraging reports with reference to the work of rebuilding the burned district was that of the San Francisco Planing Mill Owners' Association. Fifteen of the thirty-nine mills escaped the fire and two of them were now in operation. The Lumber Dealers' Association estimated that there were 70,000,000 feet of lumber on hand or en route to the city, and also available large stores of timber near by. It was agreed that there would be no immediate rise in the prices of the material owing to shortage.

Three of the handsomest buildings in the business district were to be restored as soon as men and material could be secured. The first of these buildings is the St. Francis Hotel, the second is the Crocker Building and the third is the Shrove Building. All these structures were gutted from cellar to roof by the fire, but unharmed by the earthquake. Their reconstruction would consist of naturally nothing but a replacing of floors, partitions and fittings.

SANTA FE TO RUSH WORK.

President E. P. Ripley, of the Santa Fe Railroad, gave instructions to immediately spend the $300,000 recently set aside for the completion of the company's China basin terminal. During the past two years the Santa Fe spent more than $2,000,000 in filling in the basin and preparing it for tracks and freight warehouses. The $300,000 mentioned was to be used for building these tracks and warehouses, and thus put the terminal in shape to use within the next sixty days. The earthquake and fire did not damage the terminal, and the Santa Fe people expected there would be a pressing use for their new terminal in the near future for the handling of cars laden with material intended for the rebuilding of San Francisco.

For the first time since the earthquake street lights were burning in San Francisco on the night of the 26th. The lighting company had been hard at work for several days with a large force, installing a system of arc lights on three different routes. Restoration of the telephone system was making good headway. Forty telephones were in operation, but the dyna-

miting of walls temporarily put some of them out of commission again. The clearing of the streets continued, and large quantities of debris were being hauled away from the business district.

The Oakland *Tribune* said:

"An engineer states that the area devastated by fire in San Francisco approximates 10,000 acres, or about fifteen square miles. There are few cities in the world where so much valuable property is contained in an equal territory. Within this fifteen square miles were nearly 100 banks, some of the finest buildings in the world, thousands of merchants and manufacturing establishments.

"Notwithstanding the enormous and widespread destruction, the homes of 150,000 people are still standing and virtually uninjured. There still remains the great shipyards at the Potrero, the Pacific Mail docks, the stockyards at South San Francisco, the docks and manufactories along the water front from Mission Creek to Hunter's Point, the Mint, the postoffices and a large district on Fillmore and Devisadero Streets."

NOTICE

***While the last page of the text in this book shows 416 pages, it really contains nearly 500 pages, for the large number of beautiful full-page illustrations are not included in the numbering of the pages. These magnificent engravings form a very important part of the book and bring the number of pages up to nearly 500.**